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JOURNAL *of* FORESTRY

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FORESTRY AT THE FIRST INTERNATIONAL CONGRESS OF SOIL SCIENCE

EDITORIAL

At the First International Congress of Soil Science, held in Washington, D.C., on June 13-22, nineteen papers* were presented bearing either directly or indirectly upon some phase of forest soils. Such a large number of papers devoted to the subject of forest soils is very gratifying, as it shows a growing interest in forest soils as a distinct phase of soil science.

As was natural, the papers dealt with some particular local problems or with some particular factor in forest soils. This may explain why there seems to still exist a great diversity of opinions as to what the most essential controlling factors are in forest soils. Some papers were devoted to the acidity and the technique of determining it in forest soils. Others dealt with the physical or chemical properties, or especially with one single physical or chemical factor, such as the nitrification, or the compactness, or the physical structure of the soils. It did not leave one unifying principle that would go through as an underlying fundamental idea regarding forest soils, except the classification of forest soils. The Russians have apparently, in their concept of the soil as a living entity which is subject to definite laws of evolution, developed a scheme of classification more or less universally adopted and which sheds light both on the origin of soils, their interrelationship, and their relation to vegetation cover, as well as prediction of their future development.

A notable contribution, probably more than at any other soil congress, was the emphasis laid upon the flora and fauna of the forest soils, particularly the bacterial and fungal life within the forest soil in its relation to forest growth.

* A list of these papers is printed elsewhere.

Forest soil science, like silviculture, must naturally remain to a large extent a local problem. Just as there can be no universal silviculture for all types of forest, there can be no universal formula for treatment and management of soils applicable to all forest soil types. In one locality the limiting factor may be moisture; in another, nitrification; in a third, structure; in a fourth, biological activity. Yet what seemed lacking, especially on the chemical, physical, and biological side of the discussion, was a comprehensive concept of the relative importance of the different factors, and their interacting and integrated effect upon forest growth.

If one were to draw a conclusion of his own from the different papers presented, it could be formulated something like this: The process going on in the soil that is most important to the vegetation and fauna found in and on it is the transformation of organic matter (carbon) and of the nitrogen compounds combined with it. Carbon and nitrogen are the most essential substances for all life development. They are present on our globe in such relatively small amounts that, if life is to be maintained, it is absolutely essential that the natural cycle of transformation of these substances remain unbroken. Forest soil management consists of controlling the conditions which may hamper or encourage this transformation. *The most important problem, then, in forest soil investigation is to trace in general the carbon and nitrogen cycles and the factors which control them.*

SUSTAINED YIELD AND AMERICAN FOREST PROBLEMS

By David T. Mason
Forest Engineer, Portland, Oregon

SUMMARY

Definitions: Sustained yield forest management consists for a given forest in limiting the average annual cut to the continuous production capacity. Such regulation of cutting is most advantageously applied to a unit of forest area sufficiently large to supply continuously an efficient sized plant operating at or near capacity converting the forest products into salable material. The sustained yield management unit should be regarded as including not only the forest land involved but also the logging development, the mills for conversion and the community economically dependent upon the enterprise.

The most important American forest problems may be stated as: first—the timber supply problem, or the problem of meeting continuously the requirements of the American people for supplies of forest products; second—the community problem, or the problem of keeping forest soils regularly engaged in the work of growing trees so that dependent communities may have maximum permanent prosperity; third—industrial prosperity, or the problem of stabilizing timber ownership and operation in such fashion as to bring prosperity to timber owners and operators.

Conclusions: At present we are taking annually from the forests of the United States about 30,000,000,000 feet of softwood lumber and about 7,250,000,000 feet for uses other than lumber; in addition fire, insects and disease are destroying 5,750,000,000 feet. This is a gross depletion of about 43,000,000,000 feet of softwood. The annual growth of softwood is placed at about 6,000,000,000 feet, leaving a net annual depletion of about 37,000,000,000 feet. At this rate of net depletion our remaining stand of softwood timber, estimated at 1,349,000,000,000 feet, would last about thirty-seven years. The production of softwood east of the Rocky Mountains is declining at the rate of about 700,000,000 feet yearly; this will continue. In the Rocky Mountain states production will not change greatly. In the Pacific Coast states total production is increasing at the rate of about 700,000,000 feet yearly; this will continue.

The United States imports of softwood, or its equivalent, exceed the annual exports by about 2,000,000,000 feet. The world situation of softwood is such that the United States cannot expect to meet its future needs by greatly increased imports. Our future requirements will probably continue indefinitely to be very large, and they can be met only by growing within the United States nearly all that is required.

If we are to come anywhere near meeting our future softwood requirements, we must start production. General economic conditions, including state and federal policy, have never been of such a nature as to stimulate effectively the growing of large quantities of softwood timber on private lands from which nearly all of our present supply comes. Reasonable changes in government policy together with the earnest study of possibilities by the principal private timber land owners will result in the wide introduction of sustained yield forest management, which will solve the problem of American timber supply, the problem of communities dependent upon the forest industries, and will bring prosperity to the forest industries.

INTRODUCTION

Early this year the writer prepared a paper on sustained yield and sent it to a considerable number of the people most interested for correction, criticism, comment and suggestion. About ninety letters were received and in addition from time to time up to the present, there have been conversations with more than ninety different individuals, discussing the paper in some detail. The writer is now in a position to revise the paper with the benefit of the many valuable suggestions.

This paper restates many facts familiar to those interested in this subject—there is nothing new under the sun—but it is hoped, using the same old familiar colors, but perhaps combining them in a new way, to paint a picture of vitally important possibilities for the solution of American forest problems.

It is the aim of this paper to show that the broad application of sustained yield forest management upon those properties where it is or can be made economically practicable, will simultaneously:

1. Enormously promote the practice of forestry, thereby doing the utmost to solve the timber supply problem;

2. Make permanent many communities, villages, cities, railways, etc., which otherwise with a continued migratory industry would either pass away entirely or shrink greatly in size and prosperity; and

3. Put the lumber industry especially on a stable and continuously profitable basis.

THE UNITED STATES SOFTWOOD TIMBER SUPPLY SITUATION

This paper deals exclusively with the softwood timber situation, referring only incidentally to hardwoods in a few places, and then quite specifically.

TABLE 1

SOFTWOOD SAWTIMBER DEPLETION IN THE UNITED STATES

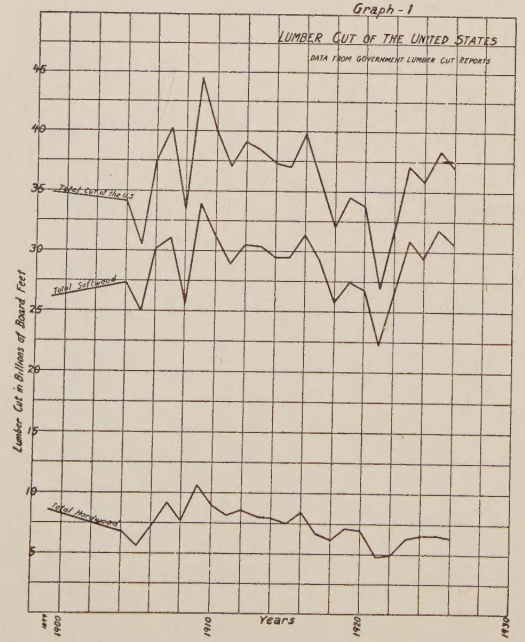
	Based on United States Forest Service Reports Made in 1920 and 1924		*Writer's Guess at Average Depletion for Several Years in the Future*
	1920	*1924*	
Hewn Ties	525	420	420
Pulp Wood	1,400	2,145	2,500
Round Mine Timber	375	440	400
Fencing	660	660	660
Poles	200	200	200
Shingles	890	900	750
Vehicles Stock, Handles, Woodenware, Furniture, etc.	20	2	2
Export Logs and Hewn Timber	100	50	80
Veneer Logs	120	104	123
Cooperage Stock	215	457	450
Piling	70	140	150
Excelsior	15	15	15
Fuel Wood	1,500	1,500	1,500
Lumber	32,000	28,275	30,000
	38,090	35,358	37,250
Destroyed by Fire, Insects and Disease	3,750	5,750	5,750
Total	41,840	41,108	43,000

NOTE: Reports are:

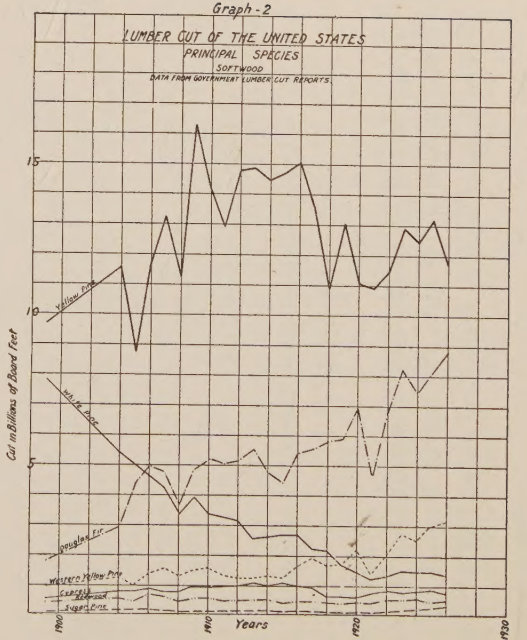
Timber Depletion, etc.—Report on Senate Resolution 311, June 1, 1920
Future Pulp Wood Requirements, U.S.D.A. Bul. 1241, July 29, 1924

Gross Annual Timber Depletion: Table 1 shows the depletion of softwood of sawtimber size in the United States based on Forest Service reports made in 1920 and in 1924. This table shows the cut of lumber and all other products of importance; it also shows

Graph - 1



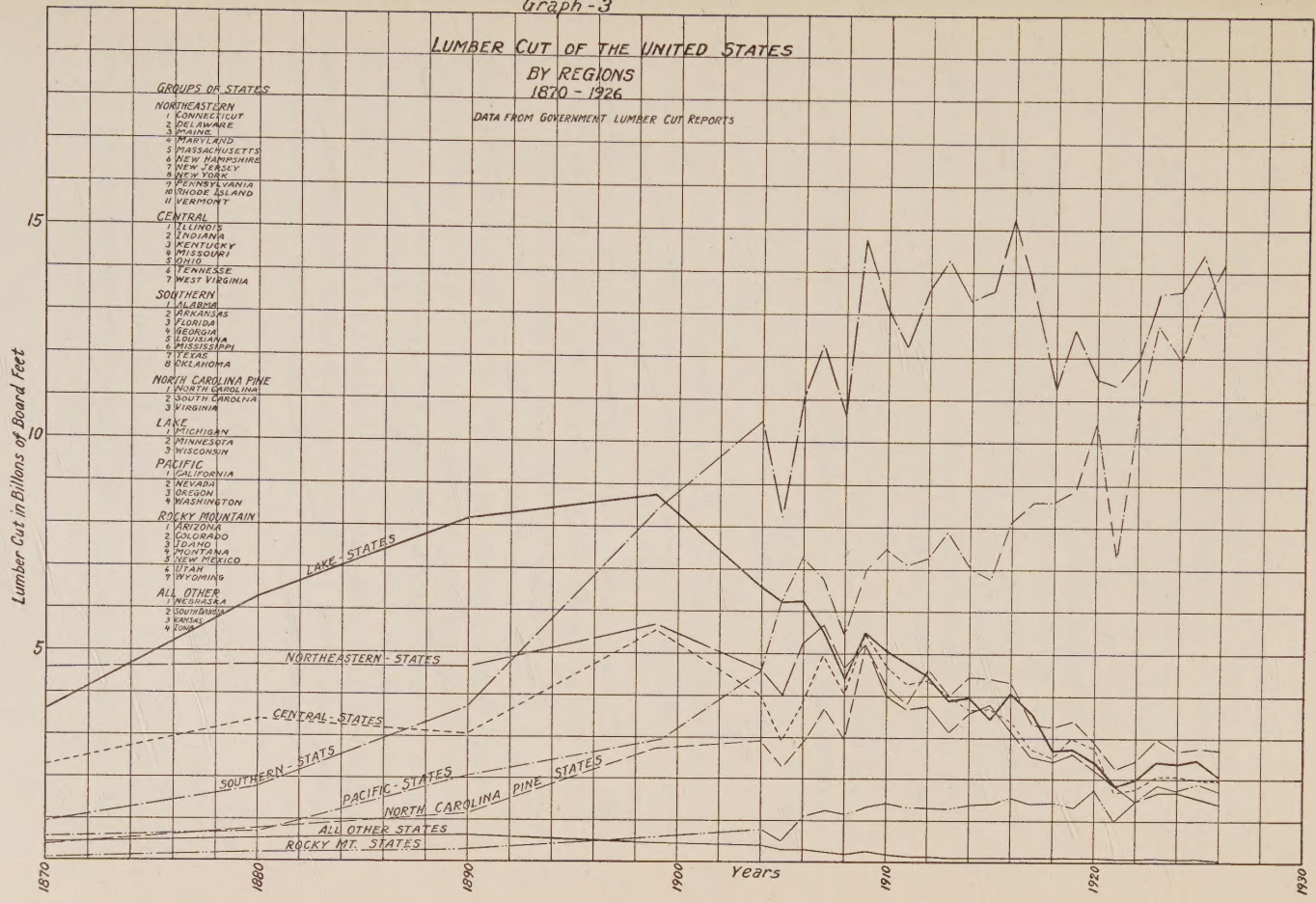
Graph - 2



Graph - 3

LUMBER CUT OF THE UNITED STATES
BY REGIONS
1870 - 1926

DATA FROM GOVERNMENT LUMBER CUT REPORTS



the estimated losses due to fire, insects and disease. The third column states the writer's guess that the gross average depletion of the next few years will be 43,000,000,000 feet.

Graph 1 shows the total cut of lumber, also softwood only and hardwood only since 1899. While the production of hardwood is now somewhat lower than in the years from 1906 to 1916 inclusive, the softwood cut averages about the same.

Graph 2 shows the cut of the more important softwood species.

Graph 3, beginning with 1870, shows the cut of lumber (hardwoods and softwoods combined) in the important producing regions. The Southern states are still maintaining a high production; the three Pacific Coast states exceeded the Southern states in production for the first time in 1926 with a cut above 14,000,000,000 feet. Four regions, namely, the Lakes states, the Northeastern states, the Central states and the North Carolina pine states, each produced slightly more than 5,000,000,000 feet in 1909, but since that time each has declined in production to about 2,000,000,000 feet present annual production—a net aggregate decline for the group of about 13,000,000,000 feet annual production. The Rocky Mountain states have made a long gradual climb to nearly 2,000,000,000 feet production. All other states have declined from a production of approximately 600,000,000 feet in 1890 to about 60,000,000 feet at present. The average annual production increase of the three Pacific Coast states from 1899 to 1926 has been at the rate of 415,000,000 feet; from 1916 to 1926 their average annual increase has been 600,000,000 feet.

Gross Annual Growth: In the Forest Service reports upon which Table 1 is based, the annual growth of softwood taking place in the country is estimated at approximately 6,000,000,000 feet. In Table 2, column 1 states by regions the Forest Service data on growth of combined hardwood and softwood; in the second column is given a rough estimate of the growth of softwood only in the different regions which goes to make up the Forest Service total of 6,000,000,000 feet for softwood.

If 6,000,000,000 feet of estimated softwood growth was correct at the time it was made, that figure is now probably somewhat high, because the enormously increased number of small mills in certain Southern states have been rapidly cutting a large share of the second growth timber in that region which was counted upon to produce the annual

growth. Furthermore, the naval stores industry is also making heavy inroads in small timber which, if left alone, would produce a substantial part of the growth. Some whose judgment is of importance believe that the softwood growth is substantially more than 6,000,000,000 feet yearly; and others who have studied the situation are equally sure that the growth is less than 6,000,000,000 feet.

Net Annual Depletion: The figures on quantity of softwood cut annually are much more reliable than the estimates of the quantities lost through fire, insects and disease, and the quantity of annual growth. Data not yet published places the losses from fire, insects, disease and

TABLE 2

GROSS ANNUAL GROWTH OF SAWTIMBER

Forest Regions	*Forest Service estimate of hardwood and softwood combined.*	*Writer's estimate for softwood only based on Forest Service figures.*
	Millions of Board Feet	
Northeastern	1,323	600
Lake	988	400
Central	1,458	177
Southern and Carolina Pine	4,180	3,100
Rocky Mountain	461	461
Pacific Coast	1,262	1,262
	9,672	6,000

windfall much higher than those given in Table 1; but possibly these larger quantities are more or less offset by unestimated growth in virgin timber. The gross depletion for the next few years has been estimated at 43,000,000,000 feet annually. From this the growth of 6,000,000,000 feet must be deducted, leaving a net annual depletion of 37,000,000,000 feet. The losses from fire especially should be reduced in the future; it is possible that the growth has been underestimated; also there may be some decline in market requirements.

Timber Supply as Related to Net Annual Depletion: The Forest Service 1920 report states the total stand of softwood sawtimber in the United States at 1,755,000,000,000 feet; of this 1,364,000,000,000 feet were in the Rocky Mountain and Pacific Coast states, and 391,000,000,000 feet were in the states to the east. In 1923 there was prepared for the Senate Forestry Committee a more accurate estimate of western timber. Assuming that the 1920 estimate as revised in part in 1923

gives the best starting point, the writer has revised the estimate somewhat further for the redwood region upon which he has especially reliable data; then after adjustments have been made to allow for cutting, for losses and for growth, it is estimated that as of January 1, 1927, there remained a total of 1,349,000,000,000 feet, of which 1,082,000,000,000 feet are in western United States (in Rocky Mountain and Pacific Coast States) and 267,000,000,000 feet are in eastern United States (all other states).

If net annual depletion continues at an average rate of 37,000,000,000 feet, and if our existing supply is correctly estimated at 1,349,000,000,000 feet, then in about thirty-seven years our softwood sawtimber will be completely exhausted. And this depletion will include not only all the softwood now of sawtimber size, but also all that grows to that size in the next thirty-seven years.

Of course there are some very important "ifs" in the previous paragraph, and it should be emphasized that we are dealing here with many factors which have never been accurately determined, and which are subject to considerable variation as time passes. The more important variables include the quantity of timber, its accessibility, how much may be put into parks; the growth, which will vary with area in forest, intensiveness of protection, intensiveness of reforestation, etc.; the losses from fire, insects, disease, windfall, etc., which will vary with degree of protection and other features of management; the rate of cutting, varying with market requirements, pressure to cut, extent of adoption of sustained yield, etc.; the degree of utilization, varying with market conditions, degree of plant and by-product development, etc. A study of the data available emphasizes the great need for a detailed census of timber quantity, growth, losses, and utilization, to give us much more reliable data; and such a census to be most useful should be by fairly small geographical units.

FUTURE SOFTWOOD TIMBER REQUIREMENTS OF THE UNITED STATES

Opinions vary greatly as to future market requirements. Some say that substitutes will ultimately take the place of a large share of the wood which we are now using, thus greatly reducing the drain upon the forests. On the other hand, there are those who believe that there will be even heavier demands upon the forests in the future to supply the raw material for many uses other than lumber as, for example, pulp for paper, board, etc., pulp for new special uses like the

rayon industry, also raw material for many new uses, including such things as ethyl alcohol, sugar, and various other chemicals.

We have every reason to believe in a greatly increased population; below are given census figures for the past forty-six years, and also what the writer believes a conservative guess at the figures for the next fifty years.

1880	50,155,783	1936	132,000,000
1900	75,994,575	1946	147,000,000
1910	91,972,266	1956	162,000,000
1920	106,422,000	1966	177,000,000
1926	117,136,000	1976	192,000,000

It seems unreasonable to suggest that our per capita consumption will decline to a figure anywhere near in line with those of countries in which there is much less economic activity per capita. We have a domestic commerce much larger per inhabitant than that of any other country. We employ more power per inhabitant than any other country; our per capita consumption of power derived from human effort, coal, petroleum and water has been calculated in an article in the March, 1927, *Atlantic* to be, as compared with some other countries, as follows:

China	1	Australia	8.5
British India	1.25	Czechoslovakia	9.5
Russia	2.5	Germany	12
Italy	2.75	Belgium	16
Japan	3.5	Great Britain	18
Poland	6	Canada	20
Holland	7	United States	30
France	8.25		

Per inhabitant we use more paper, more automobiles, build more roads, construct more public works, develop more water power. In many other ways it can readily be shown that our economic activity is greater than that of other peoples. It is reasonable to expect that activity to continue for at least a considerable length of time. It is perhaps reasonable to expect other peoples, so far as they are able in their efforts to become more prosperous, to increase toward us in the matter of activity and timber consumption. All of our activities in the aggregate result in the consumption of great quantities of raw materials of which wood is one of the most important. To predict that we shall decline substantially in our total consumption of wood

in the United States seems equivalent to being unreasonably "bearish" as to the future prosperity of the United States.

It is true that great quantities of wood substitutes are being used, but so far, at least, these substitutes have done no more than prevent the expansion of the total softwood lumber production. Some of the lumber substitutes are made of wood. The vigorous trade extension work planned for the lumber industry doubtless will bring more successful competition with the substitute manufacturers.

It is perhaps not unreasonable to anticipate that, on the average for many years in the future, our markets will continue to require about 37,000,000,000 feet of softwood.

WORLD TIMBER SITUATION IN RELATION TO UNITED STATES NEEDS

Everyone knows that the great softwood forests of the world occur mainly in a belt in the Northern Hemisphere across northern North America, northern Europe and northern Asia. Some softwood forests occur outside this great belt.

There is one fairly large body of softwood timber in Brazil, but probably little of it will ever come to the United States, for there is certainly no more than is needed for use in South America.

Generally the softwood forests of Europe are managed on a sustained yield basis; their product is practically all needed in Europe. However, in the part of northern Russia which is not especially accessible to water shipments, and across Siberia there is a great forest area of low grade timber, of light stand per acre, which at the present time is utilized much below its capacity to produce trees. To bring this timber to the United States there would usually be involved long rail shipments, then long water shipments—a costly process perhaps comparable to shipping lumber by rail from Idaho, Montana and Minnesota to Portland, Oregon, and then shipping it by water a long distance. There is great difference of opinion as to the world importance of this region. Some say that it is the great, undeveloped softwood timber reserve of the world. Others are convinced that its importance has been much exaggerated, and that the low quality and the logging and transportation costs will prevent it from contributing any substantial quantity to the United States supply; furthermore it is suggested that political conditions in northern and eastern Asia will keep this timber tied up indefinitely, and that when political conditions become favorable for large operations the markets of the Orient will be ready to absorb

the entire cut. Probably if this timber comes to the United States at all it will be at a price which will not compete severely with the home product; it may and probably will affect our foreign trade.

The softwood forests of Mexico have an estimated stand of approximately 130,000,000,000 feet, which, however, will be quite insufficient to supply the Mexican home demand when Mexico reaches a higher plane of economic development. Probably no considerable quantity of timber will come to us from these forests; the timber imports of Mexico now exceed the exports. The Central American countries have perhaps from 50,000,000,000 to 100,000,000,000 feet of softwood, a quantity of no great importance in this situation, especially when one considers the undeveloped character of those countries and their own probable needs when developed.

In eastern Canada the pulp and paper industry is already highly and probably over developed with reference to the capacity of the forests to supply continuously the wood requirements of the existing industry. We cannot expect much if any increased production from the forests of that region, especially as a strong effort is being made to place the principal companies there on a sustained yield basis.

British Columbia with a present cut of about 2,600,000,000 feet is believed already to have reached or passed the sustained yield capacity of its forests. Quite likely the cut will continue to expand for a time, but while this expansion will furnish additional competition for the producers of the United States, the over cutting will require a later contraction of production which will prevent any increased supply coming to the United States in future years when we shall most need it.

In Alaska practically all of the timber worthy of consideration is in the National Forests. There are about 80,000,000,000 feet of this timber, which will allow an annual cut of approximately 1,000,000,000 feet on a sustained yield basis, as compared with a present cut of about 50,000,000 feet. This is the only substantial body of timber in North America upon which the United States can depend for additional timber to be cut on a sustained yield basis.

UNITED STATES SOFTWOOD EXPORTS AND IMPORTS

In 1925, a recent representative year, the United States exported a total of 2,669,000,000 feet of lumber, timbers, logs, etc.; of this about 90 per cent, or about 2,400,000,000 feet, was softwood. The total exports were distributed to Japan 24 per cent, to United Kingdom 14 per

cent, to Australia, 9 per cent, to Argentine 8.6 per cent, to Cuba, 5.6 per cent, to China 5 per cent, to Canada 5 per cent, to Mexico 4.4 per cent, to other countries 24.4 per cent.

In 1925 the United States imported a total of 2,142,000,000 feet of lumber, timbers, logs, etc.; of this about 91 per cent, or about 1,946,000,000 feet was softwood. The softwood came almost exclusively from Canada. In 1923 the United States imported in the form of pulp wood, wood pulp and paper the equivalent of 2,430,000,000 feet of softwood timber; 70 per cent of this came from Canada. Thus our total imports of softwoods, or their equivalent, are about 4,400,000,000 feet yearly and about 80 per cent from Canada. Our total softwood imports exceed our exports by about 2,000,000,000 feet yearly.

THE UNITED STATES MUST PRODUCE THE TIMBER WHICH IT REQUIRES

Since in future years it is apparently going to be impracticable to secure any substantial additional quantity of softwood timber from sources outside the United States, we must grow within our borders nearly all of the timber which we shall need, or go without.

FUTURE DEPLETION IN EASTERN UNITED STATES

Since we have a situation in which the cut is declining rapidly in one part of the country while increasing rapidly in another, it will be well to examine each separately. In eastern United States (all states east of the Rocky Mountain States) it is estimated above that we had on hand on January 1, 1927, a total of 267,000,000,000 feet of softwood sawtimber. In this part of the country the 1926 cut of softwood lumber was 14,700,000,000 feet; it is estimated that the cut for other purposes was 5,000,000,000 feet, that the quantity destroyed was 1,500,000,000 feet, and that the growth was 4,300,000,000 feet; this gives a present net annual depletion of 16,900,000,000 feet.

The cut of softwoods for all purposes in eastern United States was about 7,000,000,000 feet greater in 1916 than in 1926. It is assumed that during the next decade, ending with 1936, the cut will continue to decrease at the rate of 700,000,000 feet yearly. It is also assumed that better protection will reduce the quantity destroyed annually from 1,500,000,000 to 500,000,000 feet, and that the annual growth will be increased from 4,300,000,000 to 5,300,000,000 feet. Thus the net annual depletion will be reduced from 16,900,000,000 to 7,900,000,000 with an average for the decade of 12,400,000,000 feet.

So the 267 will be reduced to 143,000,000,000 feet on hand January 1, 1937.

For the decade ending with 1946 it is assumed that the total cut will fall off at the rate of 500,000,000 feet yearly, that destruction will decline at 30,000,000, and that growth will increase at 200,000,000 feet yearly. Thus in 1946 the net annual depletion will be reduced to 600,000,000 feet yearly, and the quantity on hand at the end of that year will be 100,000,000,000 feet.

It appears likely that, with increased practice of forestry (including protection), by 1946 eastern United States will be able to produce about 7,000,000,000 feet annually, and later will gradually increase this quantity, without further net depletion.

FUTURE DEPLETION IN THE ROCKY MOUNTAIN STATES

It is estimated that the Rocky Mountain states had on hand January 1, 1927, a total of 210,000,000,000 feet. About three-fourths of this timber is owned by the public, and it is mainly National Forest timber. The total cut in these states is now averaging about 2,000,000,000 feet yearly; with losses at 1,000,000,000 and growth at 450,000,000, we have a net annual depletion of about 2,500,000,000 feet. In view of the ownership of most of this timber, with definite plans for sustained yield management for the National Forest timber, it is believed that with increased growth and reduced losses the region will produce about 2,250,000,000 feet on a sustained yield basis.

FUTURE DEPLETION IN THE PACIFIC COAST STATES

The three Pacific Coast states have been left for final consideration because here is the last available great reserve of timber of the country, here alone cutting is increasing rapidly, and here there is a combination of circumstances which give a favorable opportunity to restrain production effectively. Here is the critical situation.

It is estimated that these states had on January 1, 1927, a total of 872,000,000,000 feet. In 1926 the cut of lumber was 14,200,000,000 feet; it is estimated that cut for other purposes adds 1,500,000,000, and that destruction adds 3,250,000,000 feet; growth is estimated at 1,250,000,000 feet. Thus the present net depletion would be at the rate of about 17,700,000,000 feet yearly.

What will happen to the forests of these states in the future? Of course it is impossible to predict with any assurance, but in order to

get a more definite idea of our forest problems some figures are given by way of illustration. These figures are *not* predictions, but merely illustrate a set of conditions which might exist. Accepting the assumptions previously made for the Eastern and Rocky Mountain states, assuming that the country will continue to use about the present quantity of softwood from its own forests, and assuming that cutting will continue *unrestrained* in the Pacific Coast states as long as sawtimber lasts, something along the following lines might happen.

For the decade ending with 1936 assume that the present net depletion is 17,700,000,000, that the total cut will increase 700,000,000 feet yearly, that destruction will decrease 100,000,000 yearly, and that growth will increase 350,000,000 feet yearly. This will give an average annual net depletion for the decade of about 20,000,000,000 feet. If there is on hand 872,000,000,000 feet to start the decade, then it would end with 672,000,000,000 feet remaining.

For the decade ending with 1946, assume that the total cut will increase 500,000,000 yearly, that destruction will decrease 50,000,000 yearly and that growth will increase 350,000,000 yearly. This will give the decade an average annual net depletion of about 22,700,000,000 feet, and would leave at the end of the decade 445,000,000,000 feet.

For the decade ending with 1956, assume no change in the total annual cut, a decreased destruction of 25,000,000 yearly, and an increased growth of 350,000,000 yearly. This gives an average annual net depletion of 21,400,000,000 feet, and leaves at the end 231,000,000,000 feet.

For the decade ending with 1966, assume no change in the total annual cut, a decreased destruction of 25,000,000, and an increased growth of 350,000,000 yearly. This gives an average net annual depletion of 17,600,000,000 feet, and leaves at the end 55,000,000,000 feet.

The remaining quantity is enough at the rate of 17,600,000,000 feet net annual depletion to run on for about three years. Then there would be exhausted not only the 872,000,000,000 feet to start with, but also all that had reached sawtimber size in the forty-three years from the end of 1926 to the end of 1969. Then the industry would be through until more timber grew to usable size.

In the above it is assumed that protection against losses from fire, insects, disease, windfall, etc., becomes continuously more effective. Also it is assumed that all lands cut over are immediately reforested

on an intensive basis, securing dense and uniform stocking by planting on the better soils, and fairly good stocking from seed trees on the poorer soils. This is the sort of forestry which might be practiced where sustained yield is applied, but which is likely in few places as long as unrestrained production keeps up the cutthroat, ruinous competition. Consequently with unrestrained production, which is assumed for the above calculation, we could expect less growth and a period shorter than forty-three years for cutting the timber.

Actually we shall not cut to the end of the timber supply in the Pacific Coast states as fast as the markets will take the timber, for there are already brakes set which will in time become effective, although that time is a long way off. The privately owned timber of the three coast states is approximately 60 per cent of the total. Most of the public timber is in the National Forests, and much of that will be cut on a sustained yield basis, which reduces by several years the period during which production can run wild without brakes in private timber, if private timber is cut just as fast as the market will absorb it.

Once more it is emphasized that there is considerable question as to just how much timber of merchantable size actually now exists in the west, how fast second growth is coming on, and how much of the merchantable size timber is so extremely inaccessible as to be unlikely to be cut even when demand becomes extreme.

The writer has roughly estimated that the forests of the Pacific Coast states have a sustained annual yield capacity of about 14,000,000,000 feet. This checks fairly closely with figures in the Forest Service report of 1924 previously referred to. If it were economically feasible, an ideal way to handle the forests of the Pacific Coast states would be to restrain the cut indefinitely to the present quantity, to improve the effectiveness of protection as assumed above, and to practice intensive reforestation with the results suggested above. If this could be done, we would reach the end of 1966 with 495,000,000,000 feet of timber still on hand, with destruction decreased to 1,250,000,000 feet yearly (it can never be entirely eliminated), and growth increased to 15,250,000,000 feet yearly.

We cannot hope and it would cause unreasonable economic disturbance to attempt to bring into existence instantly such an arrangement as that suggested in the previous paragraph. But we may hope to see within a few years the adoption of sustained yield on a large number of the most important properties and operations in these states.

SUSTAINED YIELD CAPACITY OF VARIOUS DIVISIONS OF WESTERN UNITED STATES

For different regions and divisions of the west, Tables 3 and 4 give crude estimates of the practicable sustained yield and the increase or decrease of the present cut which would take place if each of these regions and divisions were placed on a sustained yield basis.

TABLE 3

APPROXIMATE PRESENT CUT OF LUMBER AND OTHER PRODUCTS, PRESENT TIMBER STAND, AND SUSTAINED YIELD CAPACITY

Billions of feet

Division	*Present Cut*	*Present Timber Quantity*	*Annual Cut If On Sustained Yield Basis*	*Change of Present Cut Necessary To Be On Sustained Yield Basis*	
				Increase	*Decrease*
1 Southwest Oregon	1.0	190	3.2	2.2	
2 Northwest Oregon	2.8	100	1.8		1.0
3 Southwest Washington	2.0	100	1.8		.2
4 Northwest Washington	6.2	100	1.8		4.4
5 Eastern Washington	.4	40	.5	.1	
6 Eastern Oregon	.9	80	1.0	.1	
7 Idaho	1.1	80	1.0		.1
8 Montana	.5	50	.55	.05	
9 Other Rocky Mountain States	.7	80	.7		
10 California Pine	1.7	200	2.9	1.2	
11 California Redwood	.7	60	1.0	.3	
	18.0	1080	16.25	3.95	5.7
					3.95
				Net	1.75

These tables also state for each division and region the estimated quantity of standing timber, and the present lumber cut.

The estimates for the different regions usually include large quantities of timber which is extremely inaccessible; for example, a report for Montana just published by officers of the Forest Service, shows that approximately 23 per cent of all of the timber is now accessible, while approximately 46 per cent is indefinitely inaccessible—that is, it is extremely inaccessible and there is no telling when, if ever, it

will be accessible; the remainder of the Montana timber is of intermediate accessibility; of course, the private timber averages much more accessible than the public timber. In nearly all of the other regions a somewhat similar situation exists, excepting that the percentage of extremely inaccessible timber is no doubt unusually high in Montana.

TABLE 4

APPROXIMATE PRESENT CUT OF LUMBER AND OTHER PRODUCTS, PRESENT TIMBER STAND, AND SUSTAINED YIELD CAPACITY

Billions of feet

Region	*Divisions Included*	*Cut Present*	*Present Quantity Timber*	*Annual Cut If On Sustained Yield Basis*	*Change of Present Cut Necessary To Be On Sustained Yield Basis*	
					Increase	*Decrease*
Douglas Fir	1, 2, 3, 4	12.0	490	8.6		3.4
Redwood	11	.7	60	1.0	.3	
California Pine	10	1.7	200	2.9	1.2	
Inland Empire	5, 6, 7, 8	2.9	250	3.05	.15	
Other Rocky Mountain States	9	.7	80	.7		
		18.0	1080	16.25	1.65	3.4
						1.65
					Net	1.75
Washington, Oregon, California	1, 2, 3, 4, 5, 6, 10, 11	15.7	870	14.0		1.70
Idaho, Montana, Other Rocky Mountain States	7, 8, 9	2.3	210	2.25		.05
		18.0	1080	16.25		1.75

Other regions in which there is a rather high percentage of extremely inaccessible timber are, no doubt, other Rocky Mountain states, Idaho and eastern Washington.

In several of the divisions, as for example in Idaho, the present cut is apparently quite close to the cut if on a sustained yield basis. However, a closer examination shows that in Idaho nearly all of the cut is north of the Clearwater River while a large share of the remaining timber is south of the Clearwater River. This, of course,

means that in Idaho some localities are cutting rapidly while others are cutting relatively little, if anything.

If something like the present cut is to be maintained in Idaho, there must be a transfer of operations from the active to the undeveloped localities; this is taking place. There are other similar situations in the West. Since sustained yield consists in part in securing a proper balance between the developed capacity of a logical milling point and the production capacity of the forest area logically tributary to that milling point, it is obviously easier to start sustained yield in underdeveloped than in overdeveloped units, although the latter is by no means impossible. Forestry does not merely take cut over land and do the best possible with it, but it is organized forest management, which is most effective if planned as completely as practicable before there is a sawmill plant put on paper, a foot of railway line planned, or a tree cut. This inevitable opening up of new operations gives a fine opportunity to start or expand in many places on a well planned sustained yield basis.

SUSTAINED YIELD AND FUTURE DEMAND

If by 1937 we have succeeded in putting the principal forest regions on a sustained yield basis, how much production will we have available as compared with market demand? It has been estimated that our markets will absorb about 37,000,000,000 feet of softwood yearly; in 1937 our production on a sustained yield basis would, it is estimated, be about as follows: Eastern states 10,000,000,000, Rocky Mountain states 2,000,000,000, Pacific Coast states 14,000,000,000, and Alaska 1,000,000,000, total 27,000,000,000. We should then have a deficit of production as compared with market capacity of about 10,000,000,000 feet. How would this deficit be met? Far closer utilization would help a great deal. Higher prices then prevailing would perhaps reduce exports and bring additional imports, and substitutes would have to make up the balance.

THE HARDWOOD SITUATION

The Forest Service 1920 report estimates 460,000,000,000 feet of hardwoods in the United States. Hardwood growth is estimated at 3,700,000,000 feet yearly. The Forest Service 1924 report estimates the total annual cut of hardwoods for all purposes at 17,600,000,000 feet, and the annual destruction at 1,500,000,000. This gives a net

annual depletion of 15,400,000,000 feet. At this rate of net depletion we had left on January 1, 1927, a total of 352,000,000,000 feet, which is enough to last twenty-three years if net depletion continues at the same rate. A declining net depletion as the result of more growth, less cut and less destruction will probably give a longer life. Reduced production of hardwoods will for some purposes throw heavier demands on softwoods; for other purposes, for which only hardwoods will do, tropical hardwoods will probably be the solution. Substitutes for wood here also will help to meet the deficit.

CHANGES IN TIMBER VALUES

An old story often repeated is the tale of the movement of the lumber industry from the Northeast to the Lake States, to the South, and finally to the Pacific Coast. This movement has resulted in great changes in lumber prices and timber values.

The value of any particular tract of timber, like that of any commodity, is fixed by the general economic law of supply and demand. In general, goods which are available in unlimited quantities have no value. A hundred years ago the Lake states timber, the southern pine timber, and the Pacific coast timber had no value, for the people of the Atlantic coast had available locally an "inexhaustible" supply of timber. Later the timber of the Lake states began to be used in substantial quantities, but its value was exceedingly low because the supply was "inexhaustible"; still later a situation had developed in the Lake states under which the operating sawmills did not furnish all the timber needed in the northern Mississippi Valley. Then it became necessary to bring in timber from outside, especially southern pine. In the earlier period there were plenty of sawmills and plenty of timber in the Lake states to supply all needs. The so-called "marginal supply" of timber was located in the Lake states in the less accessible parts of the timber then being utilized. Just as soon as the Lake states forests no longer supplied enough timber for the markets the marginal supply moved into the South.

The marginal supply at any given time is that final portion of the product which it is necessary to bring to market at the greatest total cost in order that the market requirements may be filled. Those who possess and convert marginal timber usually receive a price for the product about equal to the cost of conversion, so that there is nothing left as a return on the standing trees themselves. In other words, *for*

immediate conversion, marginal timber has no value, although it may, and usually does, have a "fair market value" as standing trees, based upon the expectation that it will some time cease to be marginal timber and will then have a conversion value; the fair market value of such timber is in reality the expected future value, discounted to the present.

For many years southern pine remained the marginal timber supply for eastern United States, and as the marginal supply it had relatively little value. Later the marginal supply moved to the West, and then the Southern and Lake states timber increased substantially in value.

The principal marginal supply of timber for the United States has been located for a number of years in the West. But not all western timber is marginal timber. In the West from place to place there are great differences in the cost of production, as well as great differences in the species and quality of the timber. At any given time for many years in the West some timber, because of its species, quality and accessibility, has had substantial value; other timber, barely able to return operating costs, has been in the marginal class; and still other timber, unable to repay operating costs, has been in the submarginal class. Within the West the marginal supply is slowly but steadily moving back from tidewater and common carrier rails to more difficult situations. The marginal timber in the West is now so situated that a large volume of lumber can be produced for many years at production costs increasing only slowly because of decreasing accessibility.

Over production of lumber tends to reduce lumber prices and thereby to pull the marginal class back into the more accessible better quality timber. Reduced production tends to produce the opposite effect. Over production reduces profits and tends to reduce timber values. Low returns and low timber values result in low degree utilization and discourage the practice of forestry.

In the West in general in order to encourage action favorable to providing a future timber supply, to protecting community welfare, and to give reasonable profits to the forest industries we need larger returns from timber conversion than we are now receiving; but in view of the economic law of marginal supply, we cannot expect substantially higher returns until the marginal supply is pushed from its present location into timber of substantially lower quality and less accessibility. Such a movement of the marginal supply will benefit not

only western timber but also all other timber remaining in the United States, excepting such as is even less accessible, economically, than the new marginal supply. The wide adoption of sustained yield forest management will result in moving the marginal supply from its present location into much less accessible timber of the United States, Canada and to a limited extent probably into some other regions such as Russia and Siberia.

SMALL MILLS DEMORALIZE INDUSTRY

During the past few years several southern pine operators have come to the Pacific Coast. It is understood that when they made their plans for their western operations, they had in mind a much more rapid reduction of cut in the southern pine region than has actually taken place. To the surprise of everyone, the southern pine cut did not decline as much as anticipated. What happened is a matter of common knowledge, but the Forest Service statistics on lumber cut and number of mills tell the story definitely. This government data shows that in the states of South Carolina, Georgia, Alabama and Mississippi in 1920 there were 2,632 mills; in 1925 there were 4,601 mills, an increase of 75 per cent in number. In 1920 these states cut 3,906,000,000 feet of lumber; in 1925 they cut 7,709,000,000 feet, an increase of 97 per cent. During the same period of years, the total number of sawmills in the United States decreased very slightly, and the total cut, as shown in Graph 1, increased approximately 28 per cent. During these years, as shown by Graph 3, the Southern states group increased their cut from 11,500,000,000 feet to 14,400,000,000 feet, an increase of 2,900,000,000 feet, or 25 per cent. The states of Georgia, Alabama and Mississippi, which fall in this group, increased their cut by 3,300,000,000 feet, or slightly more than 100 per cent. Thus these three states more than accounted for all of the Southern states increase.

It is probably safe to say that, if it had not been for this horde of new small mills in the South, the demand upon western timber in 1925 would have been at least 3,000,000,000 feet greater than it actually was. These small southern mills have been cutting some remnants of old growth, but mainly second growth which should have been left longer to grow. Upon this second growth the Forest Service has been counting for a portion of its 6,000,000,000 feet of estimated annual growth; many of the trees counted upon to make the growth have now been removed. If the principal operators in these four states had

taken steps to place themselves upon a sustained yield basis ten or fifteen years ago, there would have been no opportunity for this small mill fiasco, for the larger operators would have secured possession of much of the second growth as the basis for continuous large mill operations. Instead they left the second growth lying loose for the horde of small millls. Thus the principal southern mills overlooked at home larger profits than those to be made in buying old growth western timber, and by doing so they left the door open for the new small mills to deluge the market.

There is reason to believe that the small mill production of the South is now just about at or past its height and will soon fall off quite rapidly, for much of the second growth has been cut and the larger mills and others are picking up what is left. A similar situation should never be allowed to develop in the West.

OUR PRINCIPAL FOREST PROBLEMS

We have as our principal forest problems the timber supply problem, the community problem and the industrial prosperity problem. The application of sustained yield forest management to the principal forest properties in the country—especially to those in the Pacific Coast states—will automatically solve all of these problems.

The Timber Supply Problem: The consumers of the United States need now and in all probability will need in the future a large and continuous supply of the products of softwood timber. At present our gross depletion is about seven times the quantity replaced by growth annually. Since we cannot expect to import any large share of our future needs, we must grow within the United States regularly as crops most of the timber which we shall need.

Few consumers look far ahead if their immediate needs are being supplied; at present over production is supplying these needs super abundantly, and many years are required to grow trees. While this appears to be primarily a consumer's problem, in reality it is a producer's problem, for in general it is the business of producers to foresee consumers' needs and to have the goods ready when they are needed. The producers in this case are timber land owners, private and public.

For many years, foreseeing difficulties ahead for its people, the United States government has sought to solve the timber supply problem. Its efforts so far have consisted mainly in creating and administering the National Forests, in contributing moderate sums of money

to encourage co-operative forest protection, and in studying technical forest problems. The more progressive states have moved more or less adequately in the direction of creating reasonable economic conditions for the private production of timber; some states have acquired and are managing for timber production relatively small areas of forest land. Some timberland owners have made progress in managing their own lands for permanent timber production, but the percentage of private lands so managed is still small.

While we realize that we have a serious timber supply problem, while we want to solve it and have taken some steps in that direction, we have not yet gone far enough to solve the problem within a reasonable length of time; and time is immensely important in this particular problem.

Numerous obstacles have prevented a solution of the problem. Private timber owners have found difficulties in the property tax situation, in less effective forest protection than is practicable, in the absence of sufficient data on forest growth, and especially, although unconsciously, in their own ignorance of the possibilities of forest management on their properties. State and federal governments have not yet in general done what they might properly and reasonably do to fit the scheme of taxation to a permanent forest industry; they have not provided reasonable protection for the forests in general; they have not adopted policies for handling the public timber which bring adequate co-operation with private efforts toward sustained yield operation. If both the public and private owners could see the situation clearly and act reasonably, we would be in a fair way to solve this problem. Intelligent co-operation can provide a solution, which to be effective must be sound economically and must be acceptable both to the public and to the private forest owners.

The lands from which more than 90 per cent of our timber supply comes are privately owned. If we are in future to have considerable timber for consumption it must be grown largely on these private lands. The only effective reason which will or should induce private owners to engage in raising timber crops is the belief that it will be profitable. They must have favorable economic conditions for the enterprise; and they must be realizing sufficient present profits in their business to furnish the funds and the optimism for the venture. If as consumers we expect to have producers grow timber for us we must expect to pay the price.

The wide application of sustained yield will, of course, furnish the timber for future needs, for that is exactly what sustained yield is; but in addition sustained yield, as indicated later, will make the industry prosperous, thus furnishing the required funds and optimism.

The Community Problem: In the past the forest industry generally has been a nomad, going from region to region to harvest the ready grown timber, without thought of reproducing the forests, although starting some second growth by accident. This process has brought a boom and finally a bust to innumerable communities. What use to repeat in detail what we all know has happened in the past? Let us rather plan and work for better things in the future.

From the community point of view we want the lands which are principally valuable for tree growing used for that purpose permanently in an organized way to their capacity. We want this so that dependent industry may run steadily at capacity, furnishing the maximum permanently in employment, in payrolls, in local markets, and in traffic. We want relatively large units of production which can afford to utilize closely, can develop by-product plants, and which will develop good sized towns which can furnish more of the satisfactions of life than the little towns of "hay wire" operations.

In other words we want sustained yield, for this is it; and nothing else is an acceptable substitute.

The Industrial Prosperity Problem: The lumber industry of the West has just passed through three lean years, is well along in a fourth, and no substantial improvement in sight. The average company during this time has had no profits. Lack of business is not responsible for this serious situation for western production has been increasing at the rate of more than 600,000,000 feet yearly for the past ten years, and at no time faster than during the more recent years. Over production, actual or potential, with cutthroat competition, has made it a buyers' market with resultant low prices. This situation has, of course, reacted to the disadvantage of eastern producers as well.

Your typical western lumberman is not optimistically contemplating profits to be made from growing timber to supply future markets; he is extremely busy just now grimly trying to get back a new dollar for an old, and trying to be ready in time to meet the next payroll; he is busy trying to keep alive, and to do it utilization practice is suffering. He knows that over production is causing the trouble; he wants to see everyone else curtail, and in some instances is both willing

and able to do it himself. He wants most earnestly something which will restrain production and restore prosperity in the industry. Sustained yield when widely applied will do this, but it cannot be widely applied immediately.

We all want prosperity in the industry for it is necessary to a solution both of the timber supply and the community problems.

Sustained yield applied on many of the more important timber properties, especially those in the Pacific Coast states, would limit production to something less than present consumption; for present national consumption is considerably more than our forests *as they now exist* can supply continuously without reduction. Our forests after they have been under intensive management for many years can again and permanently thereafter probably produce as much as we now consume, but before that stage is reached we must go through a considerable period of reduced production; and the longer we put off starting to reduce the more we shall have to reduce when we do get to it.

Ultimately most timber cutting will be on the basis of sustained yield. For twenty-five years or so sustained yield may not become an effective regulator of production, but each property, either in western or eastern United States or in Canada, that is put on a sustained yield basis, brings nearer the time when we shall have effectively regulated production. With a reasonable spirit of co-operation, and by intelligent, voluntary action on the part of a number of important owners of western timber, we can within a few years apply sustained yield to a sufficient portion of our forests to regulate production effectively.

In order to have sustained yield change the lumber market from a buyers' to a sellers' market, we do not need to hold the cut of the Pacific Coast states to 14,000,000,000 feet; all that is necessary is to withhold from cutting a moderate quantity below what the market would readily absorb. This would automatically force less accessible and lower grade timber than that now being cut to become our marginal supply; and this would increase prices.

It is emphasized that it is not expected that everyone, or even a majority, will adopt sustained yield; but with government co-operation it is believed that a sufficient number of important producers, who find it economically practicable, will within a few years voluntarily adopt sustained yield and will thereby effectively apply the brakes to production.

Sustained yield is making advances in the Southern states where the reserve supply, in the form of second growth, is not so heavy a financial load as in the West. Action of private owners by themselves in this direction in the West is harder because of the relatively large amounts of old growth timber as compared with second growth. Therefore, in the West especially there is great need for public co-operation in carrying the timber burden. The solution of the problem in the critical Pacific Coast states will help enormously everywhere. A solution in the West becomes constantly more practicable as cutting reduces the proportion of private timber to the publicly owned timber, provided the public is willing to co-operate with its timber.

STEPS TOWARD SUSTAINED YIELD

The first step toward sustained yield on the part of any forest owner is an earnest, intelligent, and thorough study of the possibilities of sustained yield in general and as applied to his own individual situation. A mere superficial and perhaps prejudiced guess on the subject will accomplish nothing—indeed, such action is positively harmful; it is necessary to get the basic facts and interpret them intelligently. To be effective the investigation must be made by someone thoroughly competent to do the work. This is no more a job for anyone inexperienced in this particular field of work than would be the designing of a battleship, the planning of a military campaign, or the conduct of an important surgical operation.

There exists an enormous variety of individual situations, but to illustrate roughly what such an investigation will sometimes disclose, the following situation is outlined. The "Company" owns a sawmill cutting annually about 60,000,000 feet, advantageously located to cut all of the timber on a large watershed. The company now owns enough for twenty years' operation. Other private timber scattered through the company timber is sufficient for an additional ten years' operation. The Forest Service owns enough additional timber for twenty years more of operation. Has such a situation any possibilities for sustained yield, and if so, how can they be worked out? Undoubtedly there are possibilities, provided that another operator does not come along, buy some private and some Forest Service timber, start a new mill and spoil the opportunity.

Part of the problem of the existing operator in such a situation is to secure effective control of all or substantially all timber, both old

growth and second growth, in the unit. So far as additional private timber is concerned, securing control may consist in having all or part of it sewed up so that it cannot get away, perhaps buying outright some key tracts, perhaps entering into one or more contracts for the future purchase of part of it, perhaps a merger bringing all or part of it into the ownership of the operating company. Some, perhaps all, of these methods might be used effectively in a given case.

For the Forest Service timber in such a situation, it would be desirable to make a contract under which the government sells its timber to the operator, to be cut as it is reached in the course of operations. At present the Forest Service policy does not provide for such action. Since the Forest Service and the National Forests were created with the main purpose of solving the nation's timber supply problem, and since no other use of the Forest Service timber could do as much to bring soon the wide application of sustained yield, it is believed that the Forest Service will (with authority from Congress if necessary) revise its policy so as to encourage strongly this sort of action. Such Forest Service contracts should, of course, provide that the private owners develop reasonably logical sustained yield units, and in good faith manage their private lands on a sustained yield production basis. Such contracts would cover many other points than the principal features mentioned above, but it is unnecessary to enumerate or discuss these other features here beyond saying that there should, of course, be provision for the Forest Service receiving the fair value of its timber as it is cut. The Federal Government should go further than present Forest Service timber and make all of its timber available for such "co-operative sustained yield units"; other government timber includes especially the revested land grant timber (of which there is said to be about 40,000,000,000 feet in western Oregon), about 35,000,000,000 feet of Indian Reservation timber, and the unreserved public domain timber.

Similarly, certain states which own considerable timber, as Washington, Idaho and Montana, should we willing to act along these lines. The Governments of British Columbia and of some of the other provinces of Canada, could, with benefit in all directions, take similar steps.

The great railroads of the West nearly all own considerable quantities of timber, in the aggregate perhaps about 80,000,000,000 feet. For these roads for their entire systems forest products constitute a con-

siderable share of the total tonnage carried; for example, in 1926 of all the tonnage carried by the Northern Pacific on its entire system 38.5 per cent was forest products; similarly the Chicago, Milwaukee & St. Paul carried 19.7 per cent, the Great Northern 11.9 per cent, the Southern Pacific 24.1 per cent. The parts of these systems operating in the timber regions of the Northwest show even a much higher percentage of forest products carried. These roads live on traffic; unregulated overproduction of lumber means eventually a tremendous diminution of traffic; while cutting regulated by sustained yield means permanent traffic in large volume enormously increased by closer utilization and future growth over what it would otherwise be. These railroads are large taxpayers; as such they cannot afford to see their most important traffic producers with their dependent communities disappear, and then take on the consequent additional load of taxes; an exchange of traffic for taxes would be a poor trade. Furthermore, these railroads as timber owners are glad to see timber values advance. These roads have the strongest of incentives to adopt for their timber lands such a policy as that advocated for the Forest Service and other public timber.

OBSTACLES TO SUSTAINED YIELD

Numerous letters and conversations, following the distribution of the earlier article on this subject, show that the proposed plan for introducing sustained yield has often been more or less misunderstood. While nearly everyone agrees that sustained yield widely applied will solve the problems of timber supply, dependent communities, and industrial prosperity, still nearly everyone feels that it is impossible or extremely difficult to bring sustained yield into action on a large scale. This view is apparently held because of the thought of many obstacles, some of them real but many of them due to misunderstanding. These obstacles are discussed below.

1. *Decline in Softwood Consumption:*

"Decline in consumption of softwood lumber is an obstacle."

There has as yet been little or no decline in the consumption of softwood lumber in spite of the action of substitutes in reducing the per capita consumption. It seems likely that the present consumption of softwood lumber, or its equivalent in wood fiber or wood products in other forms, will continue.

2. *Substitutes:*

"Substitutes for lumber will upset the plan."

If the lumber industry is to have future prosperity, the problem of substitutes must be met anyway, regardless of the application of the sustained yield plan. It is the province of "trade extension" to fight a never ending battle with substitutes, and, as indicated later, sustained yield is the necessary ally of trade extension in bringing back prosperity to the lumber industry.

3. *Better Marketing and Trade Extension Must Come First:*

"Better marketing and successful trade extension work must come ahead of sustained yield."

Trade extension is not a substitute for or a predecessor of sustained yield. Rather trade extension and sustained yield are allies necessary each to the other in making the lumber industry profitable. For the lumber industry, like every other, there exist the problems of supply and demand. The industry is now undertaking to deal with the demand problem through trade extension work. This action is necessary and desirable but deals only with one side of the supply and demand equation. So far the industry has never attempted to deal with the supply side of the equation, excepting by temporary sawmill curtailment, which is never thought of until conditions become bad, which is never more than partially successful while conditions are at their worst, and which immediately goes out of action when conditions improve. Sawmill curtailment is an arbitrary procedure which aims at curing symptoms rather than removing causes. Sustained yield on the other hand is the ultimate, basic and natural method of dealing with the matter of supply. It is at least as desirable that we consider thoroughly means of permanently regulating supply as it is to study and attempt to solve the question of demand. Of what use is it to extend markets if we extend production as fast or faster? Trade extension makes one good jaw to a nut cracker but the other necessary jaw is sustained yield. The well equipped blacksmith shop must have not only the sledge hammer of trade extension, but also the anvil of sustained yield.

4. *Sustained Yield Cannot be Immediately Effective:*

"The sustained yield plan could not be made immediately effective."

Perfectly true. But neither will the new trade extension work be immediately effective. It will take time to get either into full

operation. It is just as reasonable to take steps now to bring about the application of sustained yield, as it is to buy timber for cutting ten, fifteen or twenty years from now. In fact, it is more reasonable, for the wide adoption of sustained yield will make it more profitable to buy timber for future cutting, and in addition will enhance the value of timber already owned.

5. *Sufficient Timber Cannot be Carried:*

"To go on a sustained yield basis an operator must have sufficient timber. He cannot afford to buy enough additional old growth timber nor can he afford to reduce his present cut to the point where he will be on a sustained yield basis."

Assuming the Federal and State governments willing to co-operate along the lines indicated, there will be no need in many cases where sustained yield is practicable either to reduce the annual production below mill capacity or to increase greatly the investment in timber, for the additional timber would be mainly carried by the public owners. A comparatively small additional investment in cheap second growth would be desirable and necessary in a good many cases.

6. *Sawmills Wear Out:*

"A sawmill will not last forever."

True, but the sawmill itself is only a part of the enterprise. Railroad grades, railroad steel, equipment, log ponds, power plants, by-product plants, the good will of the enterprise, the organization, the dependent community do not automatically come to an end with the wearing out of the sawmill. Although one or another part of the enterprise may become obsolete and be replaced from time to time, the enterprise itself will go on as long as raw material is supplied and as long as demand creates a market.

7. *Mergers Must Come First:*

"Before sustained yield management is practicable it is necessary to have a number of mergers to create the large companies which can afford to practice sustained yield."

Mergers in a number of regions are highly desirable; and unquestionably the larger companies can better afford to study the possibilities of sustained yield. However, even relatively small companies, where conditions are favorable, can frequently profitably adopt sustained yield.

8. *Operators Will Not Act Unitedly:*

"The many different operators of the lumber industry will not act unitedly in adopting sustained yield."

This is perfectly true; there is no hope of united action along this line; but fortunately united action is not necessary. If public timber owners will adopt the co-operative policy advocated and if private operators will thoroughly and intelligently study each his own particular situation, one after another of the most important operators will adopt a sustained yield policy, and within a few years enough will be on this basis to produce the desired effect in regulating production.

9. *Sustained Yield in Effect Would Stimulate New Operations:*

"The application of the sustained yield plan would send up prices and stimulate new operations, thus leaving the industry as badly off as before."

Efforts to curtail production by the ordinary means, so far as they are successful, do encourage new plants and new competition. On the other hand, the sustained yield plan, instead of trying to dam up lumber production at the sawmill, goes to the source and places the forest under definite control with respect to output, limiting output not to the ability of people to build and operate sawmills but to the ability of the forest itself to produce continuously. The application of the sustained yield plan during its earlier stages would have no effect in limiting lumber production below market demand. The earlier stages would consist in placing first one and then another unit of management under such control that it would not later become the source of an unregulated flood of production. The situation is comparable to Mississippi flood control. The lumber industry in its effort to control the flood of lumber has so far, and only in time of flood, devoted its energies to temporary, hastily built levees at points where the flood does the damage; that is, to the attempted (but mainly unsuccessful) restriction of sawmill output. Sustained yield plans to go to the sources of the hundreds of tributary streams, and on each of them create a reservoir (a sustained yield management unit), which will hold the local flood and will give out to the main river a continuous, definite, moderate flow. We cannot instantly and simultaneously put a reservoir at the head of every stream, but we can establish reservoirs here and there as rapidly as practicable, and when we have enough of them established, not on every single stream but

merely on a considerable number of important streams, we shall no longer be bothered by floods.

10. *Taxation:*

"Taxation is a serious obstacle."

Of course taxation is serious, but the tax problem cannot be solved profitably by merely trying to get out of business as fast as possible. With education of the public and the adoption of sustained yield by numerous operators, we shall unquestionably receive far more intelligent and sympathetic treatment in the matter of taxes than if we try to get out of the tax burden by destroying our properties as rapidly as possible.

11. *Forest Service Policy Should be Changed:*

"The Forest Service sale policy should be modified, so that it will cease to harm the industry."

The sustained yield plan goes much further than to ask the Forest Service to adopt a negative policy. It advocates a change in the Forest Service policy so that it will not only not injure the industry but on the contrary will positively assist the industry in general, and especially the favorably situated operations, by refraining from premature sale to possible new operators, and more important by definitely contracting its timber wherever practicable for operation in due time by definite existing operators, provided such operators will in good faith manage their own lands on a sustained yield basis.

12. *Political Aspects:*

"The political aspects of the proposed public co-operation would cause difficulty."

It is true that there are important political angles to the situation, but these difficulties can and must be solved through education of the public to recognize that it is greatly in the public interest as well as in the interest of the industry that that public should co-operate in making its timber available for assistance in promoting sustained yield.

13. *Expert Study:* One of the most serious obstacles to the early adoption of sustained yield, but one which is nearly always overlooked, is the apparent belief to the average timber owner that he is entirely competent, without expert guidance, to investigate thoroughly and work out intelligently the problems involved in sustained yield.

PRIVATE FORESTRY AND ITS PROBLEMS

In working out a sustained yield program, it is not only necessary to restrain the cut to the proper quantity in the forest unit selected for such management, but it is also necessary to insure future production of timber on the lands cut over. Sustained yield and silviculture (production of trees as crops) are both parts of the business of managing forest land to get the best returns in the long run; these, together with other measures such as fire protection, constitute forestry. Silviculture is entirely practicable without sustained yield; but sustained yield cannot be practiced without silviculture. The most intensive silviculture following unrestrained cutting everywhere would solve no one of the three problems of timber supply, of communities, and of industrial prosperity; sustained yield widely applied will solve all three.

Under existing conditions, even without government co-operation, sustained yield is in numerous places economically practicable today. Even where sustained yield is not practicable, with or without government co-operation, selective cutting with maximum financial return from the present stand of timber as the main object, and with silviculture purely a by-product, is frequently sound business; or some form of silviculture may be good business where sustained yield is not practicable, and where selective cutting for financial advantage in harvesting the old crop is not important.

Some private timber owners object to private forestry on the ground that the practice of forestry will not give them the interest returns that they think they should have on the values which they think they have. Will any sound, longtime investment give such returns? In such cases it is often worth while to turn the picture the other way round; not to figure what return we think we ought to have, and then decide that forestry practice will not give it, but rather to figure how we can make the most out of what we have; or, to put it another way, by what policy we shall "lose the least." Under reasonable conditions forestry actually is good private business. It has been found to be so for generations in some older countries. In many ways we have or can create more favorable conditions for private forestry in the United States than have existed in the European countries where it has been successful.

There are three generally recognized foremost problems of private forestry, namely, taxation, protection and research. That the present taxation system of most states is a real hindrance to the private prac-

tice of forestry is commonly recognized. The public has, at least in many states, already come to the point where it recognizes the situation and is willing to meet it so far as it is clearly recognized, by working out better systems for taxing young timber. The present recognition extends only to young growth, however. The old growth also should come into the picture. Inasmuch as values in the long run depend upon earnings, it might well appear that the soundest basis for taxation of sustained yield operation units, including both old and young growth timber, together with plant facilities, stocks of lumber, etc., would be upon a value determined by capitalizing the average earnings of the unit, with the property tax applied accordingly. Such an arrangement would prevent excessive taxation.

Effective protection is necessary whether or not forestry is practiced. We have made enormous advances in protecting our forests during the past twenty years, but there is still considerable room for improvement. More effective protection will come with increasing values and with a real desire to keep timber growing to provide for future operation.

Through research amazing advances have been made during recent years in such fields as medicine, surgery, physics, chemistry, and the like. Numerous modern industries are based upon or are rather fully taking advantage of advances in knowledge made through research. In the lumber industry, at least in the part of it relating to the standing trees, there has been an equally marvelous lack of advance; so far as the effective application of various principles of tree and forest growth are any indication, most forest owners are as yet scarcely aware that trees grow. A great deal more research is needed in various parts of the field of forestry, but already there is much knowledge which might well be put into practice.

IN CONCLUSION

The principal aim of this paper is to point out the opportunities in the broad application of sustained yield management, and the vital necessity for government co-operation if sustained yield is to be made effective at an early time in regulating production.

INDUSTRIAL FORESTRY AND THE BALANCE SHEET

By J. B. Woods

Forester for the Long Bell Lumber Co.

According to the comic strips someone always is taking the joy out of life. The blow falls now upon foresters who work for timber using corporations. We are advised that our aims are economically unsound, that American dollars are too costly to be profitably employed in growing new timber crops. In short that forestry principles have little application in the field of timber management by American corporations except possibly as a gesture to hoodwink the public and stave off drastic regulation of our business.

But it is no more reasonable to accept without question the forebodings of certain gloomy foresters than it would be to derive one's philosophy exclusively from the comic strip artist. Perhaps the analogy is far-fetched and unfortunate, but the point I would make is this: the industrial foresters of today must think for themselves. And they must progress for the present at least by the old method of trial and error. They cannot rely upon the hurried conclusions of superficial observers, whether these be adverse or favorable.

I suspect that the most convincing proof of the practicability of industrial forestry could be supplied by those men who have been managing timberlands for certain eastern pulp and paper companies. They have been at the work for several years and their employers appear satisfied with results. But of course it might be argued that the older settled portions of the country present conditions particularly favorable to forest management: high stumpage values, nearby markets, and favorable crystallized public sentiment in matters like taxes and protection. Forestry elsewhere might well be termed extremely hard sledding for the private timberland operator.

So I make bold to assert that forestry principles can be profitably applied in some measure at least to the operations of any timber owner anywhere in the United States, providing the individual or corporation owns the land upon which the trees stand. Leaving out of the picture such matters as railways, mechanical and electrical engineering, the technique of cheaply converting trees into usable products, and adhering strictly to the primary function of the forester, which is to manage land for the production of trees, there still is room for and need of the best men the profession can develop.

We might as well admit at the beginning that for a long time to come the markets of this country will be dominated by virgin timber. And the manufacturer who would maintain his prestige must possess reserves of such forests adequate to keep him on a competitive basis. Second growth creeps in here and there but almost always at a disadvantage. Now where does the forester fit into an organization that handles only virgin timber?

Several years ago W. W. Ashe, of the Forest Service, demonstrated the greater cost of handling small logs and used it as an argument for forestry. I have personal knowledge of studies that have been made recently in the Lake States and in California covering the manufacture of small trees occurring in virgin stands of two lumber companies. In both cases it was shown the small trees were manufactured at a loss. Cutting small trees actually put a burden of several dollars per acre upon the larger trees in the forest. As a result of these studies, both companies are being reorganized to cut upon a basis of tree selection with the view to relogging years later. Such an application of forestry principles spells dollars for the timber owner and better still it opens an avenue of approach to permanent sustained yield.

But in some localities, such as the great Douglas fir belt, selection is impracticable for the virgin stand must be levelled. What shall the forester do here? Reforest cutover areas where second growth has no present realizable value? Or, consider the cutover longleaf pineries of the South, where steam machinery followed by grass fires has left nothing but blackened stumps. Can we afford to replant with nursery grown stock, fence against hogs and patrol for years, to grow a new tree crop of distant and unknown value?

Wherever it may lie, cutover land is, strictly speaking, an asset; it is carried on the books at some value. The issue then is clear: here is an asset similar from an accounting standpoint to timber or equipment. Does the owner desire to carry it as a non-producing item, can he liquidate it, or should he put it to work? The forester confronts the task of determining the best treatment of such land. He can estimate the capitalized earning power of the soil as a producer of trees. He can weigh other considerations too numerous to mention here and arrive at the value of the cutover area. If such a value can be realized by liquidation, he may recommend its sale. If not he probably should decide to reforest, knowing that land under trees is building values, while idle acres are a growing liability. Really it

matters not whether the owner expects to cut this new crop; someone will be glad to purchase it sooner or later. The important thing is the fundamental principle that all assets should be kept productive.

Most of us are bullish about second growth. We believe its value appreciation coupled with growth increment will pay dividends comparable with other long time investments. And we can see tremendous markets for thinnings looming above the horizon. Best of all we see a growing realization of the value of land well stocked with growing trees. Already in many parts of the country investors are buying such lands.

We are prone to feel that in order to practise forestry we must evolve some scheme of sustained yield. In this time of timber owner migrations and pending mergers, such developments may be absolutely impossible. But they will come as the industry settles down, must come of course to complete the settling down process. Meanwhile the forester can prove his worth by converting cutover lands from dead weights to productive assets. Such work can be reflected upon the balance sheet.

CAR-WINDOW FORESTRY

By E. T. Murphey

Assistant Extension Forester, Pennsylvania State College

Traveling *may* be a good educator. Here in America we have learned that a constantly rolling stone fails to collect its share of moss. Moss may have many interpretations, probably it would be best not to go into too much detail.

We have travelers and travelers. Our current literature is filled with the Utopias discovered by them. Anything from the Outcome of Russia's Nightmare to Number of Buttons and Ribbons worn on the Czar's Coat are solved by those who go here and there. Travelers have explained the war from a month's journey. The world glances for a moment and then consigns the remnants to the waste basket.

Treasures *may* come from travel. However, they are usually in the form of superficial nothingness. We collect our valuable gems, not from the car window, but from careful thought and rooted experience. Vision is unlimited to those who constantly see while on the fly. Insight comes from growing moss.

Must we forever compare and simulate Pennsylvania forestry to that of Europe? We might just as well compare the automobile with the ox-team. There is no doubt that we have allowed too many medieval ideas to creep into our practice here already, to give modern wood growing a fair chance. Here, where a single machine does the work of a dozen men, we cannot simulate ox-team methods.

In certain respects human-kind here in America finds different methods of expressing itself in forestry as well as in many other occupations.

There are, in America, many farmers who are not adverse to growing timber. In Pennsylvania today three-fourths of the merchantable timber is in woodlots. Some of the best are in the oldest and highest specialized farming sections. Over here, too, one family holds a farm just so long as it can keep the mortgage hound off the back doorstep. Whether it is Tom James or Bill Smith, the mortgage holder, who operates the farm, the woodlot is being kept intact. Each uses it in turn, and it is surprising that timber is still kept growing. The odd part about it is that the more modern farmer is extending his woodlot by planting his submarginal land.

We in America are fortunate indeed in that forestry practice is progressing by education in American forestry, rather than by subsidy to family or interest. The man and his ability alone to forge his way by initiative and resourcefulness is considered paramount. If timber is to be grown it will be because management and business ingenuity will carry it on unaided by unsound favors.

To be sure, European forests are subdivided by well built and numerous roads. If our visitors would take the opportunity and time to travel and observe much of Eastern timber-land and particularly in the farm woodlots section, they could not help but marvel at the endless stretches of concrete and macadam highway. By leaps and bounds this veritable maze of highways is penetrating the farming and woodland areas.

National and State funds, largely derived from the pleasure riding autoist, build and maintain this highway system. And railroads—this country has the best and most efficient system in the world. The forest is not being taxed to build or maintain either, except for the ordinary real estate tax. For permanent public roads built to stand the grind of heavy traffic, this country is unexcelled. A few more years at the present pace of building, trucks will haul most of our timber products to railway and market.

Someone said a mouthful when he said that accessibility spells value from seedling to tree. With good roads and, more important still, with unsurpassed motor transporting machinery, this country can keep the costs, even with high priced labor, on a par with, or below, European levels.

Waterways we do not have and when we have had them they have in most cases been abandoned for quicker and more effective rail and road transportation. What we lose in cheap fuel hauling bills we gain in time and satisfaction and lower labor costs.

We have many places in Eastern United States and will soon have over the entire timbered regions, transportation ways just as propitious to forestry practice as in Europe. We now have carrying equipment that is unexcelled anywhere.

United States is without canals, to be sure. We had them once in many places, but like other obsolete tools they are now passé. So is the slow moving donkey which is such a valuable adjunct to them. Our water-way system is not to be bragged about and our timber may thus have to pay $10 (why not $20) a thousand more, but we save $10

worth of worry and labor in not having to wait for months for our order to arrive. In other words, quick transportation is worth more to us. I wonder whether we actually need to sigh when our transportation methods are mentioned.

Too bad! We deem it wise to abandon canal and donkey and waterway when either fails to give results. As for railroad subsidy in the form of reduced rates, they follow the system here of affixing rates on the basis of what the traffic will bear. If the freight tariff on timber is too high to attract volume of traffic, usually the companies think it good business to give more favorable rates.

In America we allow the rule of supply and demand to function in production. When the supply diminishes, price rises, and demand decreases.

How far from the facts is the statement that our all-powerful trusts are curbing the present supply of lumber. We are in the midst of a decided over-production cycle. The bankruptcy courts are reducing the supply of corporations, rather than the corporations controlling the supply of timber at the present time.

One can see why the mainstay of forestry in Europe is fuelwood. When a bundle of fagots (little more than twigs) is worth real money, it is hardly to be wondered at that the term "brush forestry" has been originated. Although we here much prefer a kilowatt of "juice" derived from water power, to finger scratching twigs for heat, we do consume a bit of fuel sized wood. 100,000,000 cords of real wood for fuel, 500,000 cords for chemical wood, 10,000,000 cords for paper, along with billions of feet of similar sized material for mine props, stakes and fence posts, go into use yearly. Of course, fuel wood here must never be considered as a mainstay of forestry practice because we do not use brush except for pea vines and ditches.

We do admit that white pine lumbering (I am afraid that "destructive" it hardly the word) competes with young pine grown in the New England States. Of course we realize that pine from the east is of lower quality than the virgin timber of the west and is therefore used for different purposes. If lumber from both sections were exported or shipped anywhere near the same distances to market, we could expect the competition to be even keener. However, as conditions happen to be, New England pine stays home, Idaho pine comes back east. More efficient methods of logging and manufacture exist in the west, but who says that present costs in the east cannot be lowered? A high

freight rate and more efficient methods will spell success to New England pine growing. And then, virgin pine during the next rotation period will not be as plentiful as it is today. *What usually happens when supply is reduced?*

As long as at present such a small percentage of the lumber consumed at home comes from abroad, we should worry about the necessity of raising a tariff wall. We must take a little in exchange for the enormous quantities now going abroad. It must be remembered that tariffs never function when production at home exceeds the demand. However, if worst comes to worst, a tariff on certain lumber products is not the hardest thing in the world to enforce for protection of home industries.

From tariff to taxes we go, to prove growing wood is profitable here. At present, we are studying taxes in an attempt to arrive at an equitable basis. Over here our aim is to tax according to what the traffic will bear, up to the requirements necessary to operate our Government machinery. We do not continue always to tax a legitimate enterprise beyond its capacity to pay. For then common sense would tell us that we would not for long have this same legitimate enterprise to tax. We are studying and learning, not sticking to the legendary past, and will lower the rate where too high and raise it where too low. There is one fortunate thing in America: our forests are not the only taxable commodity.

Our forest fires are like a sore eye to us. But who can say that progress is not being made? Twenty years ago people enjoyed seeing the woods burn, even here in Pennsylvania. Intentional setting of fire to get rid of the brush and aftermath of logging so that berries could be easily picked the next year, was common. Today none but the ignorant, who are slowly learning, persist in the habit. Railroads and industry still set fires, but they too are learning that it hurts their business to do so.

Campers and sportsmen, which includes a large percentage of our citizenship, are awakening. Fire protection systems are developing in efficiency—soon this demon will be controlled.

We do not wish to change our climate, and it is becoming increasingly easy to educate Americans against carelessness with fire. Who can prophesy that fire will always be a sore in the side of commercial forestry here?

Europe may have its wonderful advantages for its own method of forestry practice, even down to the "brush stage." America certainly has just as many advantages for its forestry practices. What America might lack in some phases, she makes up tenfold in human ingenuity and exercise of common "hoss-sense."

European methods, take them by and large, will never work here. Probably that is why our friend Schenck is so certain of unprofitable timber growing here. He does not, in his line of reasoning, seem to use other than thought on the European basis. He seems to forget that methods, costs, profits, and even minds work differently here.

Schenck does not even seem to grasp the compound interest problem we work on here. If he would have occasion to drop into most any old bank in any old town and ask the banker what he considered was a good long time investment return, he would have to split his figure of 8 per cent in half, to match the reply. If we can get this figure year after year, compounded as we go, we think it is good. I think if he would let a few of us in on some of these 8 per cent compound interest investments that we could relieve him of some of the strain of carrying them.

Schenck contends so strongly that forestry does not pay, yet can he account for Mr. Wilson's statement in the JOURNAL with regard to his company in Canada, which is only one of the many growing timber in North America. And further, the fact that coal companies, paper companies, and lumber companies, one after another, with millions in the background, are right now growing timber on their own lands. Probably he does not call these activities forestry because the companies interested do not attempt to rescue their fagots.

American capital, backed by American brains, is right now growing timber in the American way. The idea is young, gaining in favor as wood sense gains a foothold, and will become one of our many promising industries. To say that it will not pay is only idle gossip.

Travel may be a good educator. It is also many times the mother of superficialities such as our friend has unloaded on us.

Who will still say we cannot practice timber growing in America?

FOREST GENETICS WITH PARTICULAR REFERENCE TO DISEASE RESISTANCE

By Carl Hartley

Pathologist, Office of Forest Pathology, Bureau of Plant Industry

GENERAL CONSIDERATIONS

It is no longer necessary to argue in support of plant breeding in food and fiber crops. Its value from the standpoints of disease control, yield, and various other qualities, is no longer disputed. In the case of forest trees the situation is quite otherwise. Most foresters and forest pathologists have yet to be convinced that hereditary improvement in forest species can be obtained quickly enough to make the effort worth while. The writer believes that properly planned work in this direction will yield results good enough and early enough to be decidedly profitable. In the following pages the subject is approached from the standpoint of the pathologist, but, as always, in a discussion of selection and breeding work, it has not proven possible to limit the discussion to any one kind of character.

It is of course true that selection and breeding will not bring increased yield as quickly in forest as it does in food crops, but it is equally true that cultural methods do not increase yields as quickly in the forest as in the field or orchard. The relative practicability of genetic improvement in forest trees is, therefore, not so much less than in other economic plants. It is further to be remembered that practically no selection has been done in forest species; the field is virgin, and much may be expected from the first effort. In the food plants the most conspicuously valuable variants have already been utilized and the obviously poorest lines already eliminated. In forests the easy and profitable first selection is still to be done.

An argument that may be brought against the practical usefulness of improvement in forest trees is that even after it is accomplished the improved stock cannot be utilized as it would be in a crop which is replanted artificially. Planting as a regular part of forest management appears to have less standing at present in forestry circles than it did a couple of decades ago. But there are now in the United States many millions of acres of which the forest has been so devastated that it can be properly regenerated only by planting. There will

always be small areas where, for one reason or another, natural regeneration will not be secured. For such planting as he must do, the forester should know more than he now does about the hereditary qualities of the trees which he puts in. In both the United States (5a, 27) and Europe (40) the charge has been made that seed collectors take seed by preference from stunted trees, because it is easier to get. On some cutting areas where planting is not necessary, the cost of broadcast burning and planting is not much greater than the cost of leaving seed trees and disposing of brush. Whenever there becomes available a really superior strain which it is desired to establish, it seems likely that there will be opportunity of one sort or another to establish it by planting operations.

It must further be kept in mind that in natural regeneration the choice of seed trees to be left on cutting areas is a thing which may have a large influence on the subsequent hereditary composition of the stand. Foresters every so often (though perhaps less often than formerly) come forward with proposals to leave for seed purposes the trees which, because of decay or other defects, are of least timber value. The likelihood of securing, by such methods, a new stand hereditarily inferior to that which previously occupied the ground, is one which needs real investigation. In one special case the leaving of decayed seed trees is apparently not objectionable. This is in the Douglas fir of the Pacific Northwest, in which (6) heart rot probably will not be a factor in second-growth, since the stand will be cut before it attains the age at which it becomes subject to significant decay. Even in this case there is some reason for inquiring into the possibility that other undesirable hereditary characters may be associated with liability to decay and perpetuated in the progeny of the decayed trees. For example, Kraebel (23) reports that seed from decayed Douglas fir trees produced seedlings which were inclined to be stunted, likely a temporary thing due to poor condition of seed, but perhaps an hereditary tendency. The immediate economic advantage in leaving decayed trees for seed production is in some cases so large and our present knowledge of the dysgenic* influence of

* Dysgenic: Tending to lower hereditary quality of future generations. Anyone unfamiliar with other of the technical genetics terms used in this paper will find them defined in the glossaries of the texts by Jones (22) and Babcock and Clausen (4). Both of these books are excellent reading for beginners in the plant breeding field.

the procedure so indefinite, that the question is certain to come to life periodically for various forest types.

In thinning the same situation is met with. "High" thinning, in which the largest and best trees are taken out because of their superior merchantability, must surely result in a remaining stand of less average hereditary vigor than that formerly on the ground; the question is as to how much harm is being done. In both thinning and felling operations we should not only guard against increasing the representation of poor lines in the future stand; so far as is practicable we should be definitely selecting to eliminate them and leave only the best. The stimulating article just published by Bates (5a) blames much of the unsatisfactory results of artificial forest regeneration on unintelligent choice of seed, and calls for immediate changes in current procedure in both planting and management to make them conform more closely to what is already known about inheritance in plants.

HYBRIDIZATION BETWEEN SPECIES

Information is available on numerous hybrids between forest species. The following list contains some of the more interesting ones:

Larix eurolepis, the famous Dunkeld larch. *L. europaea* x *L. leptolepis.* Very fast growing, and resistant to insects and fungi (1, 7, 20, 35, and further mention in the *Proceedings of the Scottish Arboricultural Society*).

Pinus sondereggi. P. palustris x *P. taeda* ♂. Resembles *P. palustris* in susceptibility to needle disease (10).

Populus eugenei, Norway poplar. Very fast growing, but susceptible to Dothichiza canker in Ohio (12, 17, 20c).

Populus serotina. Has replaced its European parent in several countries (16a, 17).

Salix coerulea. Probably *S. alba* x *S. fragilis.* The wood brings fabulous prices for cricket bats (5, 16a, 17).

Platanus acerifolia. Used in Europe as a street tree (17).

The Huntingdon elm. *Ulmus glabra* x *U. montana.* In an English plantation with nearly forty other elms, it grew twice as fast as its nearest competitor (16a).

The Lucombe oak. *Q. cerris* ♀ x *Q. suber* ♂. Extremely vigorous (16a).

Hybrids and supposed hybrids in walnut. Some are of gigantic size (12a, pp. 173-177; 22, 26).

Jackson and Dallimore (21) stated in 1926 that most of the known hybrids among the conifers were in *Abies,* and had been produced artificially. Both of the above-mentioned conifer crosses occur readily in nature. Natural hybridization among the oaks is a matter of frequent comment. Little, if any, advantage is to be expected from the hybridizing which goes on between species native to the same region, but such accidental hybrids as the Dunkeld larch have distinct possibilities.

Artificial hybridization, particularly when one of the parents is an exotic, involves numerous complications and difficulties, a few of which follow:

Pollen may have to be shipped or stored in order to have it when and where it is to be used.

In *Quercus* (28) and probably in other genera, only certain trees are receptive to pollen from another species.

There are technical difficulties in hand pollination (20).

Fraxinus monolepsis (18) may confuse the investigator by giving him supposedly hybrid progeny which is descended only from the pistillate parent. See also (26a).

The hybrids may prove sterile.

Hybrid characters must be fixed by several generations of inbreeding or backcrossing with continued selection before seedling progeny can be counted on to come true to type. For species that do not bear seed at an early age, or in breeding for a character like resistance to heart rot, which cannot be tested at an early age, fixing characters will take an impossibly long time.

Even after a good line is obtained, quantity production of seed may require several additional generations.

These difficulties will not make hybridization impracticable in all cases. Many oak hybrids show early and complete fertility (Ness in 20a). Pollen and seed production may be hastened by top-working a hybrid on old trees. Hybrids are often more capable of vegetative reproduction than are their parents (22). The early multiplication and progeny testing of hybrids can be speeded up by vegetative propagation even though ultimate large-scale use must be by seed. Such a combination of vegetative and seed propagation has been employed with advantage in the improvement of plantation tea in the Dutch East Indies (11). Some first-generation hybrid trees make very rapid growth (1, 7, 17, 18, 19, 20, 20a, 22); though many hybrids are

subnormal instead of supernormal (26, 36a), the ones that are especially fast-growing may prove extremely useful.

The old idea that rapid growth means weak wood has been pretty well exploded, at least for some of the hardwoods in which it has been investigated (12a, 16a, 18, 29, 30, 31). Where vegetatively propagated planting stock can be used and natural regeneration obtained by coppice, this high vigor may be utilized for high-speed timber production. Even where vegetative reproduction is not practicable, it may be possible to arrange to secure first-generation hybrid seed on a considerable scale, as is said to be done with the Dunkeld larch.

UTILIZATION OF GEOGRAPHIC STRAINS WITHIN SPECIES

Both in Europe and in the United States, the existence of hereditarily different geographic strains or races within forest species has long been known. A special case is presented by strains growing in the same general locality but at different elevations. The literature on these geographic strain differences is large. A useful summary is given by Roeser in an extensive manuscript report on hereditary differences in forest trees, a copy of which is filed in the Office of Experiment Stations of the Forest Service at Washington; he later published a shorter paper (35).

While these differences between geographic strains are large, there seems little likelihood that direct practical use can be made of them. In general, the strain that is most useful at any particular locality and elevation is the one that grows there naturally. Advantage is ordinarily to be expected from selecting among geographic strains only when planting is to be done with an exotic species. Exceptions to this will, of course, be found. In Ohio, cottonwood (*Populus deltoides*) from the upper Mississippi Valley is said by Karl A. Swenning to grow faster than local cottonwood, the only difficulty with the exotic strain being its juvenile susceptibility to bark fungi in Ohio plantations. When an otherwise valuable foreign strain proves deficient in one or two definite characters of this sort, it might at least serve as a basis for producing valuable hybrids with the native strain. Evidence summarized by Jones (22, p. 278 *et seq.*) is to the effect that the crossing of varieties from different localities may result in more vigorous progeny than does crossing of varieties native to the same locality. Seitz, however, warns (36) against promiscuous introduction of exotic strains. He properly holds that when a stand consists of a well

adapted and fairly uniform strain, it should be maintained in future generations as pure as possible, by protecting it from pollination by other strains. This protection of a good local strain from outside mixtures has been found quite essential in some of the work with herbaceous crops, particularly where *uniformity* of product is required. A campaign to induce all growers in a particular locality to use the same strain has been carried on in connection with the growing of long-staple cotton in the Southwest. Failure to recognize the danger to local strains from outside introduction is said to have largely nulified the value of early efforts by Europeans to improve crop varieties in India.

UTILIZATION OF HEREDITARY DIFFERENCES BETWEEN INDIVIDUALS IN THE SAME LOCALITY

There is reason to think that the different individual trees in the same stand differ materially from each other in hereditary characters. Such individual differences have been demonstrated in the plant and animal species which have been most studied. It is held by some that wild species are more nearly homozygous, and, therefore, more uniform in their growth than cultivated species. That this is not always true is indicated, for example, by the striking variability recently reported in wild tarweeds (3). While forest tree species perhaps vary less than our cultivated plants, very large differences are found in some characters. Some of these are summarized in Table 1.

TABLE 1. Some characters in which differences between individual trees of the same species have been reported as apparently hereditary.

Character	*Trees*	*Authority or supporting evidence*
Habit	Numerous species	(36, footnote p. 197-8)
Habit, leaf form, color	*Thuja, Chamæcyparis, Juiperus*	Successful establishment by horticulturists of clonal varieties differing in these respects
"Snake" habit	*Picea*	Progeny tests (14)
Straightness of trunk	*Larix*	Tests of seedling progeny through 4 generations (2)
Nut qualities, length of catkin, time of leafing and flowering, growth habit	*Hicoria pecan, Castanea dentata, Juglans nigra*	(26, 37) Growth differences shown both by comparisons of clonal varieties and relative growth of stock and scion in grafted trees (C. A. Reed, oral communication)

TABLE 1. *(Continued)*

Character	*Trees*	*Authority or supporting evidence*
Number of rows of latex tubes	*Hevea brasiliensis*	Progeny tests (Planters' journals)
Yield of rubber	do	Yield nearly as high in progeny of controlled, crosses (20b) and of selected open-pollinated mother trees (35a) as in vegetative progeny of high-yielding trees
Yield of resin	*Pinus palustris, P. heterophylla*	(Lenthall Wyman, personal communication)
Proportion of resin adhering to faces as "scrape"	*P. heterophylla*	do
Yield and composition of resin	*P. pinaster*	(16)
Color and corrrelated quality of wood	*Liriodendron tulipifera, Populus deltoides, Liquidambar styraciflua*	(Smith, 38)
"Pole tops" associated with elasticity of wood and freedom from breakage and wound parasites	*Pinus silvestris*	(36)
Twisted grain	*Pinus ponderosa, P. longifolia*	Tests of seedling progeny (9, 38)
Growth	*Picea*	Tests of open-pollinated seed progeny (34, p. 405)
Open-crowned habit and correlated rapid growth	*Pinus silvestris*	Descendants of open-pollinated seed trees made average growths of 93 cm., 92 cm., 85 cm., and 70 cm., respectively, when classed in groups according to ascending order of crown density of parents (40)
do	*Pinus austriaca*	Descendants of open-crowned trees showed slight advantage, more considerable on comparing weighted averages than by the averages given by Zederbauer (40)

TABLE 1. *(Continued)*

Character	*Trees*	*Authority or supporting evidence*
Resistance to needle diseases: *Lophodermium, Hypoderma, Hypodermella,* and *Rhabdocline*	Pacific Coast pines, Abies, and Douglas fir	Boyce (personal communication)
Resistance to *Lophodermium pinastri*	*Pinus silvestris*	Progeny tests* on seedlings from open-pollinated parents (40)
Resistance to chestnut blight (*Endothia parasitica*)	*Castanea dentata*	Occasional trees live for many years after all their neighbors are killed.
Resistance to brown bast and South American leaf diseases	*Hevea brasiliensis*	(32, 33)
Resistance to anthracnose (*Gnomonia veneta*)	*Quercus alba, Platanus sp.*	Great differences are found in amount of disease on trees growing under apparently uniform conditions, so close to each other that their branches interlock.
Resistance to gall rusts, *Peridermium harknessii, P. cerebrum, and P. sp.*	*Pinus silvestris*	do
Resistance to *P. harknessii*	*Pinus ponderosa*	do
Resistance to blister rust (*Cronartium ribicola*)	*Pinus monticola*	Boyce (personal communication) reports a tree on which infections occur but are unable to extend.
Resistance to slime flux	*Quercus*	(36)
Correlated growth habit and resistance to mistletoe	*Pinus ponderosa*	(5a)

* The validity of Zederbauer's conclusion has been examined by probability methods, using the published diagram of his test beds. The percentage of pairs of nearby sample areas which showed approximate agreement in amount of disease was 86 when the areas compared were planted with seed from the same parent, and only 54 for similar pairs planted with seed from different parents. N was 89 and 72, respectively, giving standard errors of 3.6 and 5.9 for the two percentages (39, p. 257, 267), whose difference thus becomes $32 \pm 6.9\%$ and is to be considered significant.

Probably the larger share of the observed differences between trees even under apparently uniform conditions is due to environment. In wood quality, the differences in specific gravity between different parts of the same trunk are greater than the differences between different trees of the same species (30). A French test of the progeny of good versus the progeny of stunted trees from the same locality actually resulted in more rapid growth by the latter (von Shrenk, 38). Differences can be positively shown to be hereditary only by progeny tests, and when the progenies do show the same differences as the parents, the differences are not likely to be as large. Despite these necessary qualifications, hereditary differences between different trees in the same stand certainly exist and can be utilized to advantage in many cases. Selection is the first thing to attempt; with perennial plants mass selection is very useful (11, 35a), though in any species found to be self-pollinated or capable of economic vegetative propagation line selection is also promising. Real breeding work with individuals of the same species and native to the same locality cannot be recommended for most forest species under present conditions. In the consideration of white pine blister rust, later in the present paper, an attempt will be made to indicate some possible short cuts in such breeding.

SOME CURRENT ACTIVITIES IN FOREST GENETICS

Studies of the pollination of conifers are under way at Tübingen under the direction of Dr. Lehmann. Larch is being hybridized in Russia (20) in the hope of securing greater resistance to insects and the Dasyscypha (Peziza) canker, a very serious European disease which has just been discovered in the United States by Spaulding (personal communication). In the United States, all of the western Forest Service Experiment Stations have studies in progress bearing in one way or another on forest genetics. These are mainly in the direction of determining the differences between geographic strains. The earliest of these studies was begun in 1912. Forest tree breeding is being done at colleges in Texas and Manitoba (20a) and two privately supported projects in forest genetics for *Populus* and the conifers, respectively, have been recently inaugurated (20a, 36b). A new type of project is the prize contest announced by the *Journal of Heredity* (back cover of the June, 1926, issue) for finding the best honey locust (*Gleditsia triacanthos*) to use for bean and pod production in "tree crop agriculture" in hill country. The certified seed

idea put forward by Bates (5a) is already being put into practical form in the seed-supply stations outlined for Pennsylvania (20c) and has been urged as an international matter (22a).

SUGGESTIONS FOR FUNDAMENTAL INVESTIGATION

Of course, really fundamental investigations in genetics are best conducted with species in which generations are short. Detailed factorial analysis would hardly be worth attempting in trees. But before practical efforts at genetic improvement can be made intelligently in forest trees, there are a number of relatively fundamental pieces of investigation required. Because of the lack of continuity both in personnel and objectives which has characterized much government investigative work, and the necessarily long time through which several of the following projects would need to be carried to yield the best results, it seems likely that much of the work suggested in the following outline could best be done by permanently endowed organizations.

1. Study of the behavior of crosses between closely related species. The following phases are among those which might be examined:
   a. the readiness with which the different crosses can be made artificially;
   b. the frequency with which they occur naturally when the two parents grow in proximity;
   c. the vigor, wood quality, resistance to disease and insects, and other characters of the F_1 progeny of the cross;
   d. the practicability of obtaining, by top-working or otherwise, prompt flowering of the progeny;
   e. the fertility of the progeny;
   f. the characteristics of the F_2, F_3 and back-cross generations.

2. A similar investigation of crosses between different geographic strains in species in which the differences between geographic strains are easily recognizable.

3. A statistical study of individual variation in important species. Such studies should be made in selected even-aged stands in which soil and other environmental factors appear uniform.

4. Tests of the progeny of the more extreme variants found in such a study as the preceding to determine the extent to which the observed differences are hereditary:
   a. in vegetative progeny;
   b. in seedling progeny obtained by selfing or by controlled crosses between similar parents;

c. in seedling progeny obtained by controlled crosses between very dissimilar parents from the same stand;
d. in seedling progeny obtained by open-pollination.

5. Pollination studies in selected tree species representing different groups:

a. methods of stimulating flower and seed production in young trees;
b. time and amount of pollen production, production of pistillate flowers, relation of age and other factors to flower production;
c. methods of forcing flowers, and of storing and shipping pollen;
d. frequence of self-sterility and of cross sterility;
e. relative amount of self and cross pollination which takes place under natural conditions. What influence have stand purity and stand density on this phase of the pollination question? What distance must separate two trees or groups of trees to avoid any considerable cross-pollination between them?
f. does selfing result in decreased vigor of progeny?

6. Vegetative reproduction:

a. bring together existing evidence and conduct further tests on the relative growth rate at different ages of vegetative and of seedling progeny;
b. improve or cheapen methods of vegetative propagation for important native forest species.

Some information on these fundamental points is, of course, already available. For example, Henry (16a) reported Mendelian segregation in the progeny of an elm hybrid. Busse (8) has experimentally stimulated flower and seed production in pine by breaking off the tips of the leader and side branches. In one of the pines (13) it has been reported that the pollen tube remains dormant twelve months after reaching the ovule, before fertilization takes place. Munns (27) found *Pinus jeffreyi* self fertility, but obtained only slight indications that self pollen or pollen from weak trees results in the less viable seed than cross-pollination with pollen from thrifty trees. Data on *Hicoria pecan,* showing self sterility in some strains of the species due to lack of synchrony between staminate and pistillate flowering, have been recently published (37). Horticultural works like that by Gardner *et al* (15, Chapters 26-30) give much information on pollination and the various kinds of sterility in nut trees and other woody plants. A hybrid between two dissimilar species of *Cupressus* is reported

fertile (21). Roeser's paper (35) and the writer's have only made a beginning in reviewing the literature bearing on the subject. In the sixty titles in the bibliographies of the two papers in the original rough drafts (prepared independently of each other) there was only a single duplication. In other words, the literature bearing more or less directly on the selection and breeding of forest trees is so large that two men may wander in it for a long time without crossing each other's trails. A more complete search for published information should obviously be made before any elaborate attempt at original work in this field is started.

Vegetative reproduction, the last item considered in the foregoing outline, is a subject on which early information is badly needed. Experiments under way at Johns Hopkins University and the Boyce Thompson Institute for Plant Research are yielding results that should materially cheapen vegetative propagation, but there is abundant chance for further advance on this phase of the subject. The question in particular need of study is the ultimate effect of vegetative propagation on vigor. The fear that stock propagated vegetatively will be inferior seems to have been pretty well allayed for trees which are grown for fruit production in the temperate zone. The so-called "running out" of potatoes now appears to be due not to the mere fact of vegetative propagation but to the filterable-virus infections which are transmitted by the tubers. Rubber and cacao growers have, nevertheless, been slow to believe that such stock will make as vigorous growth as seedling stock, or be sufficiently long lived. The fear of "running out" needs to be confirmed or dispelled for tree species in which vegetative propagation would be really practicable. The information available on fruit trees will scarcely settle the question, as the fruit growers, so long as fruit production remains satisfactory, are not interested in growth of wood, and their data will probably not include measurements of a type that will satisfy the forester on the question of the maintenance of general vigor. Perhaps the forestry literature contains sufficiently good data on growth rate of coppice to answer the question for some species, so far as sprout reproduction on old roots or stumps is concerned. The great vigor of blackwood (*Dalbergia latifolia*) in Java after many generations of root-sprout reproduction may be worth investigation in this connection. There is, of course, no certainty that the early stagnation said to take place in coppice stands of some species would be met with in stands originating from cuttings or from budded

stock, in which there would be none of the handicaps which old root systems may, in certain respects (24), bring with them.

STUDIES OF IMMEDIATE APPLICATION

It is suggested that studies be made of the comparative cost of seed collected from the best trees in the stand and seed collected in the usual way. For many species, cost of seed is a relatively small item in the expense of establishing plantations. If it can be shown that the extra cost of plantations from selected seed is negligible, it will be at once possible to institute in such species a policy of seed collection from the best trees only.

The study of twist in *Pinus longifolia*, already mentioned (9), furnishes an example of directly applicable information. It is found that twist in the different stands studied is proportional to the degree to which the stands have been utilized. Stands near villages have been culled by the natives and the present forest in those places consists of the progeny of the twisted trees which were left to bear seed. Such studies point the way to the changes in management needed to prevent similar predominance of undesirable strains in other forests.

There are four of our tree groups, *Castanea, Plastanus, Populus,* and the 5-needled pines, in which, from the disease standpoint, it seems possible to secure relatively prompt results in increased disease resistance. In any specific project, attention would, of course, have to be paid to other characters as well as to that of resistance to disease; but in these four cases, disease is so important a factor that improvement should be directed primarily toward increasing resistance.

Before discussing specific projects in connection with disease resistance, it will not be out of the way to consider a fact of general application in selection for resistance. This fact has been particularly impressed on the writer from results of his selection work with peanuts (*Arachis hypogaea*) for resistance to bacterial wilt (*Bacterium solanacearum*) and seems to have been the general experience in work with other crops. If the selection is practiced in stands which have been exposed to *very heavy* infection, the chance for getting really resistant individuals is tremendously greater than if the work is done in a stand that has not been quite so heavily exposed. In a cross-fertilized species, it is probable that the individuals of maximum value in any character dependent on multiple genes will be very few in number. If 30 per cent of the plants are uninfected it is to be ex-

pected that most of these owe their escape to local conditions more than to hereditary factors. If only 0.3 per cent are disease-free, the probability that any particular one of the disease-free plants is hereditarily immune should be nearly 100 times as great.* The ideal thing is to make the original selections from large populations in which disease is extremely prevalent throughout, and conduct all subsequent progeny testing under conditions of maximum opportunity for infection. When it is not practicable to work under conditions of high natural disease prevalence, it will save time to test apparently resistant trees by direct artificial inoculations in order to weed out those whose escape has been due to chance rather than resistance. Such inoculations should be made with strains of the parasite from different localities in the region in which the resistant stock is to be grown. The situation of the grain rusts undoubtedly exists in other diseases: that a host plant resistant to one strain of the parasite may prove highly susceptible to another strain from a nearby locality.

Chestnut Blight. Search for resistant native chestnuts has been conducted vigorously by the Bureau of Plant Industry in the parts of the country where the disease has been longest present, with the co-operation of other scientific agencies, the Boy Scout organization, and the general public. While none of the resistant native trees so far discovered seem sufficiently resistant to serve as a basis for reviving our chestnut forests (G. F. Gravatt, oral communication), the search is to be continued. Hybridization of native chestnut with resistant foreign chestnut species has been handicapped by the fact that the exotics of pollen-bearing age growing in the United States were mostly of orchard rather than forest type. While the problem is difficult and the outcome by no means certain, the obtaining of a resistant strain or hybrid is the only hope of saving one of the most valuable forest trees of the country. The rapid growth, ready reproduction, and numerous uses of this tree warrant considerable expenditure on the chance of being able to regain it. The present work is to be expanded, particularly in the direction of an intensive search in the Orient, for the most resistant stock of the Asiatic chestnuts, $20,000 having been made available for this purpose in the latest appropriation bill.

* This ratio becomes 100 only when conditions for infection in different parts of the stand are absolutely uniform and the number of plants of maximum resistance is less than 0.3% of the stand.

Sycamore anthracnose. While of more importance for street planting in smoky cities than as a forest tree, the value of sycamore for both purposes might well be increased if strains resistant to the anthracnose could be isolated. The reason for suggesting it as an early subject for work is not its importance so much as the fact that it will probably be material with which to get results easily. The striking differences in resistance between adjacent individual trees have been described. Simple selection and vegetative propagation should give immediately useful results. According to Henry (17, p. 39 footnote), a hybrid known as *Platanus acerifolia* has shown unusual resistance to the disease.

Poplar cankers. The members of the genus Populus grown in the United States are, to an unusual extent, affected by bark parasites. The very unfortunate result of the Dothichiza canker, which is making impossible the cultivation of the otherwise profitable *Populus eugenii* in the Ohio Valley, has already been mentioned. This same canker, and another believed to be due to *Cytospora chrysosperma* (25), and bark diseases due to unidentified organisms, on cottonwood, quaking aspen (*P. tremuloides*) and Lombardy poplar, are, at least in some regions, very serious handicaps to the use of the poplars in plantations for paper production. With the exception of the aspen, the poplars can be readily propagated vegetatively so that it will be relatively easy to perpetuate and utilize, on a large scale, any variants found occurring naturally, or any of the large variety of forms which it should be possible to produce by hybridization. Natural regeneration by sprouts from the stump or roots is common among members of the genus, including the aspen, and if branch cuttings of aspen remain refractory, propagation by root cuttings can very likely be made to succeed for this species. Both to increase disease resistance, and because of the opportunity for utilizing the hybrid vigor which some poplar crosses are known to possess, the poplars seem very promising subjects for study. The information that they are being bred by Dr. Stout and his associates is extremely welcome.

White pine blister rust. For the present, *Pinus strobus* is the only host with which there are prospects of early results in increasing resistance. The disease has not been long enough in the Northwest to give much of a basis for work in *Pinus monticola.* While it appears fairly certain that the rust can be controlled at reasonable expense in most *P. strobus* country by Ribes eradication, there are certainly

some localities where, because of abundance of Ribes or other reasons, it will not pay to grow this species, and less valuable species will have to be substituted. If it is possible to secure more resistant strains the frequency and thoroughness of eradication can be safely decreased and much of this doubtful or marginal territory may be profitably kept in white pine. If pine strains were selected for resistance to the destructive white pine weevil as well as for rust resistance and other characters, great advantage might result.* The general level of resistance of *P. strobus* to rust is probably higher than is the resistance of the native chestnut to blight, and hereditary improvement will be supplemented by Ribes eradication work, whereas in chestnut there is no supplementary treatment. The prospect of success in selection of white pine is therefore greater than with selection of native chestnut.

The method to be pursued is open to considerable question. Crude mass selection by simply collecting seed from the trees surviving in diseased stands containing much Ribes, may become a practicable procedure for large scale use at some future time, but at present there are no stands in which enough of the fatally infected trees has died, to make it effective. The stands, such as that at Kittery Point, which were early attacked, have been or will be cut by their owners as a salvage measure. In stands too young to be merchantable, where Ribes are especially numerous and no eradication is being attempted, a considerable mass selection will probably take place automatically in time as a result of the killing of a large proportion of the trees by the disease. Such stands should ultimately become a fair source for collecting seed for use in planting operations, until the slower but more certain methods described in the following paragraphs have time to bear fruit.

Line selection can be started at once on a small scale by collecting seed from the apparently most resistant trees, and extended as the further development of the disease in areas where Ribes are allowed to grow makes it possible to determine relative resistance more accurately. The apparently resistant trees should preferably be isolated by cutting neighboring trees to decrease the amount of pollen from susceptible parents.

If practicable, a less empirical procedure should be followed. It

* A complication in such a program might develop in view of the fact that blister rust (Spaulding, manuscript) like the true rusts in general, and also (15a, p. 8-9) the white pine weevil, prefer vigorous trees.

would be highly desirable before using trees as parents to examine the degree of really hereditary resistance which they possess. The simplest way in which to test this is to propagate from the apparently resistant trees by grafts, which, according to the ornamental nurseryman, are relatively easy to secure with the 5-needled pines. At least fifty descendants should be secured in this way from each supposedly resistant parent. The clones thus secured should be planted in a generally infected region, alternating them with rows of ordinary seedlings, and of grafted stock from ordinary trees. As soon as the test plantation is well established, it should have Ribes planted through it in sufficient number to give a good differential test of the resisting power of the pine to infection. When this test has gone far enough, say ten-fifteen years, the ordinary seedlings and the trees of the less resistant clones should be cut out, and replaced so far as possible with additional grafts from the trees whose progeny had proved most resistant. The test plantation would then become a plantation for production of resistant seed.

A modification of this plan is suggested by Dr. William J. Brotherton. He would use in the test plantation not vegetative progeny of the apparently resistant trees, but seedling progeny obtained by controlled crosses between resistant trees. The two parents whose crossing resulted in the most resistant progeny, would then be used as the source of vegetative propagating material. As large a clone as possible would be obtained from each of the two trees, and the two planted in mixture and isolated from other pines for seed production purposes. If selfing one of the original resistant trees gave the best results, the plantation for seed-production would be made with grafts all from this one tree.

SUMMARY

1. Improvement of forest trees by selection or breeding offers unusual obstacles. The field is practically unworked, and it is believed that despite the obstacles, results can be obtained well worth the time and effort required.

2. Hybridization between different species or geographic strains often results in high vigor in the first-generation progeny. This high vigor and associated desirable characters can be ordinarily utilized only for trees with which cheap methods of vegetative propagation can be developed. First generation hybrids have, however, been advantageously employed even in seedling larch plantations.

3. Line selection is time-consuming and limited in its use to material for planting. Mass selection can be done on a large scale in seed collecting, in thinning and in marking, and is the procedure from which most can be hoped within a reasonable time.

4. Suggestions are made as to fundamental studies needed to furnish a basis for effective and economical work.

5. In four tree groups in which disease is an important factor, it is believed that more resistant planting stock can be secured at a relatively early date.

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LIVING STUMPS

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On the Pacific coast living stumps of Douglas fir were first described by Lamb (3) in 1899 under the name of "root suckers." Since that date Jepson (2), Newins (4), and Pemberton (5, 6) have discussed this phenomenon, which occurs also in grand fir, white fir, big tree and western yellow pine, and they conclude that it is due to root grafts. In the southern United States, stumps of the Cuban and long-leaf pines (1) may also continue to grow after the tops have been removed. No living stumps of non-sprouting conifers indigenous to the northeastern United States have apparently been reported previously.

Three stumps of hemlock (*Tsuga Canadensis*) and over two dozen stumps of white pine (*Pinus strobus*) have been found in Hanover, New Hampshire, that lived for many years, although some of them were dead when discovered. Many living stumps of the latter species were observed during the fall of 1925 in a stand where a thinning was made during the preceding winter. Also, in Ithaca, New York, thirteen living hemlock stumps were counted on an area of less than half an acre.

White pine stumps with a single season's overgrowth show a more or less continuous ring of greenish brown callus between the old wood and bark, provided growth has continued to the top. If growth does not extend to the cut surface, as is often the case, the condition of the stump can be ascertained with certainty only by the removal of the bark. While the bark of those pine stumps which lived for many years showed no appreciable difference from the bark of living trees of the same size, the bark of the older living hemlock stumps, in several instances, was more finely furrowed than the normal. Apparently the changes in the bark of these eastern species are not as great as Lamb (3) has reported in living Douglas fir stumps, but this may be due to a dissimilarity in the age of the new growth.

While only a few of the older living white pine stumps were hollow, this was the usual condition in the hemlock. A typical old hemlock stump consisted of an irregular cylinder from 20-30 cm. high and from 3-6 cm. thick, made up largely of living tissues. The overgrowth had returned in itself to the inside of the cylinder nearly

as far as the ground level. No capped stumps of either species were found.

Examination of three hollow hemlock stumps at Hanover showed that they grew on the average 33.3 years after cutting, and that the annual rings averaged .021 cm. in thickness. Eleven white pine stumps in the same locality, 52.8 years old when cut, averaged .025 cm. per ring during the next 15 years. Obviously, the rate of growth after cutting is slow in both these species, and, curiously enough, is about the same in both. A hemlock stump found at Ithaca showed 53 annual rings averaging .026 thick after the tree was cut.

In the table below are given some data obtained at Hanover during late October and early November of 1925.

Relation Between Living and Dead White Pine Stumps

	Number of Stumps	*Average No. Rings on Stump*	*Number Alive*	*Percentage Alive*	*Average Largest Diameter in Cm.*
River Flat	55	48.6	32	58	26.7
Side Hill	50	84.0	27	54	32.4

Two distinct but contiguous, even-aged, pure stands of white pine are present on the areas where the data were collected. The River Flat consists of a smooth river bench of fine sandy soil bearing trees about 53 years old. The Side Hill is a very steep slope of coarse sand and gravel, with a stand of pine about 88 years of age. Both these stands were thinned during the winter of 1924-25. On the River Flat the thinning was very light, removal being largely confined to trees of the overtopped and some of the intermediate crown classes. On the Side Hill the thinning was moderately heavy, as some trees of the co-dominant and dominant crown classes were included in the cut.

Just a year after the cutting, all stumps on typical areas in each type of stand were examined and numbered, except those of trees that obviously were dead when the thinning was made. Since all doubtful cases were included, the percentage of living to dead stumps, as shown by the figures, is certainly low rather than high. 58 per cent of the stumps on the River Flat area where the thinning was light were alive at the close of the first growing season, as were 54 per cent of those on the Side Hill where the thinning was heavier and the stand older. The average thickness of the new annual rings on the living stumps of the River Flat was .038 cm., or slightly less than $\frac{1}{7}$ the average thickness of all the preceding growth rings in the same

stumps. While the annual rings formed after logging are much narrower than the average rings put on previous to cutting, the line of demarcation between the two periods of growth is usually not distinct, because of the slow rate of growth immediately prior to cutting. During the first season after cutting, the wood formed is fairly straight-grained, but, judging by older living stumps, there is a tendency for the wood elements, in many cases, to become more and more erratic in their directions during succeeding years.

Examination during the spring of 1926 showed that three more stumps on the River Flat area and five more on the Side Hill had died. By the last of June, 1927, nine more had succumbed on the former and five more on the latter plot. In other words, 36 per cent of the stumps on the River Flat and 34 per cent of the stumps on the Side Hill were still alive more than two years after the trees were cut.

In two instances, roots of living trees connected through grafts to stumps were severed, but the stumps continued to live, for, as was found later, other root grafts were present. It was not possible to cut the living trees which might be connected by root grafts to the stumps in question and thus prove directly that the phenomenon of living white pine stumps is due to root grafts. However, this seems the most probable explanation. The only living stump examined where no root graft was found was that of a white pine seedling 1.5 cm. in diameter, and in this case there was no overgrowth. Stored food with the aid of the chlorophyll normally present in the bark may have been sufficient to keep this stump alive, but, since sixty-one other similar seedling stumps averaging 1.1 cm. in diameter were dead, it would seem more likely that a root union with a living tree was overlooked.

Root grafts were not difficult to find on the larger stumps. In one instance there were nine of them between the roots on one side of a living pine stump and a tree of the same species standing 91 cm. distant. The youngest pair of grafted roots observed were ten and thirteen years old respectively when the union took place, and the age of the one tree cut was about eighteen years. Probably root grafting does not take place until the roots are large enough so that considerable pressure is exerted when they grow in contact.

Where large openings in the stand were made by the removal of groups of trees, the percentage of living stumps was much reduced.

In one such opening containing twelve stumps, only two stumps remained alive and these two were near the edge.

Large numbers of healthy rootlets were found on the living stumps in all cases where examination was made. It would seem possible that the increased absorptive system available through root grafts, as evidenced by living stumps, may be an important factor in the increased rate of growth of certain stands after thinning.

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SPRUCE FORESTRY

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A glance at a map showing the location of the pulp and paper mills of the United States brings out the fact that most of them are concentrated in the northeastern corner—the Lake States, New York, Pennsylvania and New England. Another look at a map showing the distribution of the three mechanical sulphite woods, that is, spruce, balsam, and hemlock, indicates the reason. The great majority of pulp and paper mills are dependent on spruce, the premier of all pulp woods, and, secondarily, on balsam and hemlock. In the northeastern United States and eastern Canada is found the type of forest which contains the largest amount of these three species and especially of spruce. The west coast of North America including Alaska is the home of the western species of these pulpwood trees but the proportion of the coveted spruce in the forest is much smaller than in the eastern forests. In parts of the Rocky Mountains, the percentage of spruce in the forests is high but here, as further west, the manufacture of paper has been handicapped by other factors, such as accessibility and distance from markets. The development of the kraft paper industry has opened a new field in the South and elsewhere but only for a specialized product.

In the Eastern forests, spruce grows in quantity on four types of land—the swamps, the spruce flats, the spruce-hardwood mixture and the spruce-slope type. The spruce-slope is found on the higher altitudes on the steep mountain sides; it is limited in area and cannot supply by growth a very large quantity of wood. The swamps are poor sites where growth is very slow. The spruce-hardwood type furnishes high quality wood but usually the spruce gives way, when the old growth is cut, in part to the more vigorous growing hardwoods. The spruce-flats are more permanent and stable but again the area is limited.

Generally speaking, the spruce has a hard fight to maintain itself in competition with other species and is inclined to yield the ground either to hardwoods or to balsam. The swamps and the spruce-slope types are exceptions. The best growing land for spruce is the hardest to manage for future crops. The wild forest lands of the northeastern

United States offer a peculiarly difficult problem for paper mills which want only spruce. Nature insists on growing a variety of forest products on the same land—cedar, tamarack, pine, birch, beech, and maple—and every paper mill which owns any quantity of wild lands must own and grow and market (if possible) these other products. The pulp and paper industry faces much the same problem as that which would be faced by a tannery, using only the hides of an animal, if forced to go into the business of operating cattle ranches in order to get the hides of the cattle.

Is it any wonder then that most paper mills were, for years, deaf to the warning of foresters that the spruce woods were rapidly being exhausted? A small percentage of paper mills have acquired an adequate supply of spruce producing lands in spite of the apparent difficulties, and these will certainly survive longest and will probably become permanent. Others have made some purchases of timber lands but not adequate to meet their requirements. The quantity of wild land needed to furnish a permanent supply of pulpwood for a modern paper mill is truly amazing, and the investment, if made at present prices, mounts up to a staggering amount.

The industry as a whole has lived so far, and is living now, on wood bought in the open market, formerly all from the United States but now partly from Canada; the policy has been to pay the price asked for the wood and let the other fellow worry about timber land taxes, forest fires, interest on the investment, silviculture and everything else connected with forest land ownership. And why not? Wasn't it reasonable to suppose that the federal government or the state or some other owner would take over the job of growing forests and sell to the industry the small part that it needed? Paper manufacture is a highly specialized business whose technique and interest begins with the pulpwood cut into proper lengths and delivered into the yard ready for the grinders or the chippers. Is it any wonder then that such an industry would hesitate to acquire and manage large tracts of wild forest land when only a small percentage of the trees could be used? Through all the years when the industry was getting started, there were plenty of problems confronting the paper mill executive which had to do with the technique of making and selling paper in a highly competitive market. Every year it was easy to buy the full wood requirements of the mill and there was no time or

energy left to worry about what might happen some day if the forests failed to furnish the pulpwood needed.

Naturally it would take more of a jolt than the solemn warning of the forestry enthusiasts to force such an industry to think seriously about growing forests. Two jolts came—the unprecedented high price of pulpwood occasioned by the war and the threatened embargo on the exportation of pulpwood from Canada. The one brought home the fact of increasing wood shortage in the eastern United States and the other the real danger of shutting off whatever pulpwood might be available from Canada. The paper mill executives ceased for a brief time to consider only the immediate urgent problems of the mill superintendent and the sales manager and gave consideration to the problem of a future pulpwood supply. Forestry and its possibilities as a solution for the wood problem took on a new meaning and the foresters were invited to tackle the problem and see what could be done.

Foresters are fellows who have been trained to think in terms of growing forests. A matter of thirty or forty or sixty years to them is a short rotation and trees which can be grown in that length of time are fast growers. Moreover, they are accustomed to think of long delayed returns until the timber is mature. Of course there can be very little current revenue from a young growing forest! Our paper industry is not very old—not more than thirty to fifty years in most cases—and the board of directors of paper mills have always demanded a quick financial return for every investment. Twenty years is a long time over which to depreciate anything and thirty or forty years is an exceedingly long venture into the distant and uncertain future. Is this enough to indicate some of the differences in mental attitude and the extent of the gap to be bridged between the old régime and the new forestry idea?

In spite of the fact that pulpwood forms only a part of the product of the natural forest, the industry must assume a large part of the burden of owning and managing these forests, or substitute man-made forests for them, if it is to be sure of future pulpwood. That is the first fundamental principle which the forester must ask the paper company to accept. Neither the Federal Government nor the State nor any other agency is going to take over the burden of growing our future pulpwood and if there is any quantity to be obtained in the future, the industry which requires it must take the necessary steps to insure

a future supply. *Whatever investment is required in forest capital is just as necessary a part of the enterprise as the roof over the paper machines.* That is the second fundamental upon which the forester and the paper mill executive must agree if any progress is to be made. The time has passed when a spruce mill can expect to continue permanently in business without owning and managing for sustained yield the forest properties from which the bulk of its pulpwood requirements are to be met.

Now comes some more encouraging angles of the problem where the forester can really begin to score. *It is cheaper to plant and grow pulpwood by forestry methods than to continue buying wood cut from wild forest land,* even if the end of such a source were not already in sight. Because of the difficulties in managing wild lands, already pointed out, the cost per cord of the pulpwood obtained, even under the most favorable conditions, will always be high. The present costs of delivering pulpwood to the average mill allows a wide margin over the cost of planted spruce located within a short haul distance of the plant. If available in quantity today, the product of planted spruce forests would offer cheaper pulpwood than is now being obtained. This can be proved to the satisfaction of the financial powers of the corporation. All through the eastern United States there are millions of acres of abandoned farm land which have been accumulating for half a century or more. It is reported on good authority that there are at least two million acres of abandoned and absolutely idle farm land in New York State alone. New England, Pennsylvania and all the states along the Atlantic seaboard have other thousands and millions of acres of such lands, very much in proportion to their total area. Such lands will grow on one planted acre, in thirty or forty years, three to six times as much spruce pulpwood as nature grows on the average acre in the north woods in twice the number of years. As I say, these are facts which can be fairly conclusively shown.

Here we have an advantage over the tannery. The latter could hardly grow cattle where even the majority of the product was the hide but we can grow timber (man planted and tended) with 90 to 100 per cent pulpwood as the product. Pulpwood forestry on selected sites in pure stands of spruce is an entirely different proposition from trying to grow pulpwood on areas of natural forest land where nature insists upon having a large variety of trees and products.

So far, so good, but what about the pulpwood to supply the mill in the meantime? That is a question which must be answered, and the sooner the better. Obviously, we must look to the existing forest lands for this supply. The forester naturally turns first to a report by the United States Forest Service called Bulletin 1241—"How the United States Can Meet Its Present and Future Pulpwood Requirements." We can glean some very interesting facts from this publication. The "available" (to the paper industry) supplies of spruce, fir and hemlock pulpwood in the northeastern United States are estimated in round numbers to be 75 million cords. If Canada continues to contribute to our wood pile in the same quantities as she has done during the past five to ten years and if our own mill consumption remains stationary, this reserve of wood will last the entire industry twenty-five years. No growth is figured in that. This Bulletin estimates the growth at 183 million cubic feet or, roughly, one and a half million cords each year. We know enough about old growth forests to know that they do not grow very much and that, over large areas, growth and decay about balance. Therefore this growth must be in young forests which have escaped the fires. If this accumulates it will extend the cutting period over another ten or twelve years or long enough to grow planted forests! That is fine and very simple, you say. Yes, but try and find it—either the mature stands or the mythical young growth.

Here is a fair sized job for a good many foresters, aided and abetted by timber brokers, consulting foresters, state forestry departments and temporary assistants. One fact can be very soon established. The remaining stands of merchantable pulpwood are pretty tightly held by pulp and paper companies who fully appreciate their value. They are not for sale. Speaking in a very general way, this is true, but there are some tracts for sale and it is possible to buy at least enough American wood on the stump to tide over an emergency. We have no detailed forest inventory to consult and none, or very few, forest type maps. In some respects it is a good deal like looking for a needle in the proverbial hay stack. But there are other sources of pulpwood and wood pulp besides even our American and Canadian supplies.

Then there is that other source of supply already mentioned—the young forests said to be producing one and a half million cords annually. The task of locating and segregating enough of this second

growth for feasible management is an even more difficult task then finding the merchantable timber. Something can be done, but generally speaking, each mill must take its chance of buying its share of this young growth timber from the general market as it becomes merchantable. Here the interest in nation wide fire protection of existing forests becomes a very real, selfish interest. *This young timber must not burn.* Its ownership is very widely scattered even as the type itself is widely scattered. The increasing number of good roads makes economical marketing of small volumes of wood practicable and a mill can therefore expect to pick up a surprisingly large amount of wood as time goes on.

In brief, the problem of supplying a pulp mill with wood during the next thirty years, unless extensive forest lands are already owned, cannot be solved with mathematical precision. Steps can be taken to provide sources of supply here and there which will give reasonable assurance of perhaps 51 per cent of the mill requirements. Beyond that, for mills not already well supplied with timber lands, the cost would be entirely prohibitive. The day has long since passed when it is within the power of any forester to get together an acceptable area of forest land in the eastern United States for permanent management of spruce, fir and hemlock wood sufficient to supply a sizable paper mill. We are forced to take at least a 49 per cent chance upon sources of wood other than American or the possibility of substitution for spruce, some coarser or shorter fibered wood with the full knowledge that this may mean substituting a new or different product for that now being sold.

The future rewards for a far sighted policy of planting spruce loom very large, however; spruce has always been and we have every reason to believe it will always continue to be the very best wood for sulphite or ground wood pulp or for high grade paper. It is getting scarcer every year. Will not the mill of the future which has an ample supply be in a very strategic position in relation to competitors who are forced to use inferior raw material?

And that leads me to the question of substitutes. This is an age of miracles and strange things have happened in the industrial world. The scientists of the chemical laboratories have made many wonderful discoveries which have changed processes and substituted one raw material for another almost over night. Paper making involves many chemical processes and we all admit that very little is known about

what actually takes place in the digesters. "How long will it be," asks the general manager, "before some chemist works out a process for utilizing pine and popple or even hardwood for the manufacture of the same kind of paper for which we require spruce wood?" From time to time we hear wild tales about some new process developed at some laboratory which promises to revolutionize the paper industry. Undoubtedly rapid progress has been made and perhaps some phenomenal developments are in store for the future. These things disturb those responsible for the forestry policy of the paper industry and very properly cause them to hesitate before deciding to spend large sums to grow spruce trees for future use. "How do we know," they say, "that long before our planted spruce is ready to cut that some new pulping process will not enable us to use some inferior species which are cheap and easy to obtain?"

This is a difficult question to answer because no man can predict what might happen in the future. We do know, however, the inherent differences between spruce and other more abundant and cheaper woods. We know, for example, that the length of the fiber in spruce (which so largely determines the strength of the paper) is from two to three times that of popple and hardwood. We know that spruce is superior in bleaching qualities and in freedom from pitch. No amount of research can ever change these facts. Further we can say that no developments of the past or promised for the future, seem likely to displace spruce as the premier wood for paper making. Perhaps the consumers may be willing to accept poorer qualities of paper made from inferior wood because the price is less but at the prospective costs of growing trees which the forester can show, this is a very remote possibility. We can only judge the future by the past and the wise paper mill executive will take steps to insure his mill a safe future supply of spruce until he knows that some satisfactory substitute is at hand. Certainly no one can doubt the future marketability of spruce wood for some purpose even if the improbable should happen and it is not needed for paper pulp.

THE RELATION OF FOREST PRODUCTS INVESTIGATIONS TO THE PRIVATE TIMBER OWNER

By Carlile P. Winslow

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To the private timber owner, forests are primarily a means to an end. His final object in growing and maintaining forests is profitably to dispose of them. To insure his continued and active participation in providing a permanent forest supply he must be assured of markets for his product sufficient in quantity, stability, and price to insure profits on his investment of time, effort, and money. Without such markets, profits disappear; without such profits, forestry disappears. Hence stabilization of markets, in its most far reaching sense, is a critical essential to the enlargement, to the permanency, and to the success of his activities.

Stabilization of markets rests fundamentally upon *suitability of product* and *satisfactory price.*

Suitability of product is determinable only by accurate, definite knowledge of its properties—and how to control them, select them, and apply them efficiently to meet the requirements of use.

Satisfactory price is limited by the price of suitable competitive materials. The private timber owner can only efficiently meet such competition limitation by reducing his own costs. This can be done by waste elimination—efficient utilization—by making one tree do the work of two. Here again progressive accomplishment depends upon knowledge of properties and of use requirements, just as does suitability of product.

The future of wood markets is in the hands of the scientists. Uses long held by wood are being contested by old materials that have been refined by science and by new materials of scientific origin, promoted in industry with the aid of extensive technical knowledge of their properties. Increasingly is heard the "Bugaboo" of the inroads of substitutes. Synthetic boards in place of lumber for building purposes; all metal automobile bodies; steel desks and spokeless wheels; fabricated steel for small house construction; concrete road bridges, asbestos and tile roofing in lieu of shingles; metal poles and posts. These are but a few of the tendencies that are rife.

In addition there is the competition amongst species. Easy transportation has precipitated a veritable war amongst species themselves—woods from all parts of the country are offered in the same markets. The consumer, in lieu of reliable knowledge of their properities must be guided by conflicting opinions and prejudices in his choice.

If wood is to be profitably produced for use in industry it, too, must be made a technical product, whose properties are known, whose variations are controlled in manufacture, whose behavior in use can be predicted.

Wood is now far from being a technical product in the final state in which it is delivered to the consumer. Forest products research has found, for instance, that of two pieces of wood, equal in size, cut from the same tree, and offered in the same market, one may be strong, and the other weak; one does not split when a nail of a certain size is driven into it, the other does split; used as flooring one dents twice as easily as the other, used in a window frame, one lasts for many years, and the other rots out in a few seasons. These are differences which the wood producers are unable to avoid in the present state of knowledge. On the other hand, industry, committed to large quantity production, to standarized design, to waste elimination, is finding less and less use for a raw material that is erratic in quality. Wood has the qualities demanded by a great variety of industries. But only through scientific research can these qualities be determined, segregated, modified, and guaranteed to meet the exacting requirements of modern use. Whether the wood producer chooses to recognize it or not, the consumer is perforce living in a scientific age, and his demands are being rapidly reshaped by it.

There are 150 important species of wood in the United States. Each of these species possesses some thirty properties of industrial significance, such as hardness, nail-holding power, tendency to shrink and swell, heat insulation, and resistance to decay. Each of the species shows a variation in these thirty properties throughout the range in which it grows. (See page 700.)

The producing trades and consuming public need to know five things about each of the thirty properties, namely, (1) how it varies in a species, (2) how to measure and select for it commercially, (3) how to increase it or decrease it, (4) its importance in each use, and (5) how to design wood products so as to take full advantage of it. This know-

ledge is essential to good wood utilization and very little of it is yet available.

There should be no misunderstanding as to what such an investigation is aimed at. In itself it will not provide the consumer with a reliable guide in purchasing wood nor will it provide the wood producer with ready-made selling arguments. The results will be chiefly useful as an inventory of the stock in trade of the thousands of timber owners

THIRTY WOOD PROPERTIES

1. Weight
2. Strength in bending and compression
3. Hardness
4. Toughness
5. Shock resisting ability
6. Stiffness
7. Resistance to splitting
8. Resistance to abrasion
9. Nail and screw holding power
10. Workability under machine and hand tools
11. Speed of drying
12. Shrinkage in drying from green condition
13. Plasticity (as in steam bending)
14. Tendency to develop defects in drying (checks, casehardening, compression set, honeycombing, collapse)
15. Stability under atmospheric changes
16. Resistance to weathering (surface fiber disintegration by sunlight, oxidation, and moisture changes)
17. Resistance to decay
18. Resistance to fungus stains
19. Resistance to insect and marine borer attack
20. Susceptibility to standard preservative treatment
21. Susceptibility to standard painting and finishing treatments
22. Gluing characteristics
23. Heat insulating properties
24. Sound insulating properties
25. Electrical insulating properties
26. Combustibility
27. Resistance to acids and alkalies
28. Permeability by liquids (as tanks and barrels)
29. Tendency to leach water-soluble contents (discoloring plaster, corroding metal, etc.)
30. Tendency to lose volatile contents (imparting odor or flavor to foodstuffs, etc.)

and primary manufacturers, and it will be the first real inventory they have ever had. Instead of evaluating this great natural resource mainly in terms of board feet, we shall have its measure in terms of properties, on which its true commercial value depends.

Knowing how each property is proportionately distributed within his stand of timber, the owner may harvest it with a view to particular markets with much less waste than he can at present.

Hand in hand with the work on properties should go the development of selective tests so that the variability of natural-growth wood,

which disregarded becomes a drawback in every use, can be converted into versatility, which is an asset, greatly extending the uses for which wood may compete on a fair basis with other natural and artificial materials of uniform quality.

About the only selective test now applied to wood is the standard grading rules. These employ only the grader's judgment of outside appearance as a measure of the thirty odd inherent properties of a piece of lumber. The consumer in making his selection usually resorts to two other unreliable guides, namely, species and locality. Suppose an employer, having found a satisfactory workman in a Swede from Minnesota, were to specify that all future employees must be Swedes from Minnesota. The situation would be analogous to that of the wood consumer who specifies maple flooring from Quebec, birch heel stock from New York, automobile-body ash from Tennessee, pine box shooks from Arkansas, and cypress siding from Louisiana, and refuses to take white oak from the Pisgah National Forest, hickory from the Appalachians, birch from Michigan, elm from Wisconsin, or white pine from California.

As one of the innumerable possibilities open to science, it should be possible to devise a fairly simple test to segregate material for manufacture into siding and sheathing lumber which would make a warmer house than the siding and sheathing provided under the grading rules. It would then be possible for the manufacturer to offer his product with a guarantee such as backs up many other materials, of a heat transmission factor of a certain number of British thermal units per hour per degree Fahrenheit per square foot per inch thickness.

Other reliable commercial tests are needed to measure and select for decay resistance, freedom from swelling and shrinking tendencies, toughness, resistance to abrasion, and many more properties in which wood exhibits a great variation.

Aside from selective tests, science promises to provide many other ways of regulating the properties of wood so as to make it exactly suited for the purpose intended.

If hygroscopicity, or the tendency of wood to absorb moisture could be cheaply controlled, the decay problem would disappear, and along with it the need for determining decay resistance and susceptibility to preservative treatment. Likewise, stability of wood under atmospheric changes would cease to be an important issue. Weathering would become a simpler problem to cope with. Gluing troubles would be reduced.

Strength properties would be no longer fluctuate in service. Insulating properties would remain constant. There is no reason to suppose that hygroscopicity cannot be controlled, and a great effort should be made to find out how to do it.

If density were controlled, as seems to be possible, during growth, then hardness, shock resistance, and other strength values could be made to fall on selected points, instead of scattering all over the chart in any one tree, as they do at present.

Loss of quality in seasoning, which occurs to the extent of ten million dollars a year in one species of wood alone, appears for the most part preventable through applied research, with a gain rather than a sacrifice in speed over current kiln-drying and air-seasoning practice. But scientific drying should not stop merely with the prevention of injury to the wood. It shows promise as a means of enhancing certain wood properties. By producing great or little shrinkage in drying from the green condition, it may in some degree regulate the hardness or softness of the wood, or increase its structural strength in the same sizes. There is also evidence that it may be able to change the wood cell contents so as to increase resistance to decay. It may partially control future swelling and shrinking. It may make wood more susceptible to injection with preservatives, or more resistant to weathering, or easier to glue and paint. These are possibilities that deserve careful study.

Studies to eliminate seasoning degrade would unmask the degrade now caused by improper planer set-up and planer speeds, and feeds, and would show the great need for more scientific adjustment between drying conditions and planer operation.

For a few uses the resistance of wood to decay is being increased, to degrees not yet accurately known, by impregnation with various preservatives. Meanwhile, unprotected wood in service is being lost through premature decay at a rate comparable in magnitude only with the destruction caused by forest fires. The research most urgently needed here is to find the most effective method of impregnating wood with materials that are toxic to the decay-producing fungi, and to devise means of preventing the leaching of these chemicals from the wood in service. Particularly, research should develop an odorless, paintable, through and through treatment to increase decay resistance in building lumber. The fire resistance of wood may also be increased by chemical treatment. There is a great need for materials with which wood in

building, furniture, and other products can be impregnated or coated to reduce the inflammability tendency and to suppress flames during burning.

Other treatments should be developed to harden wood surfaces so as to increase wearing qualities, as in flooring; to soften wood to make it more suitable for turning in lathes and working under machine and hand tools; and to retard weathering, as in shingles.

The effective use of such information as above outlined requires knowledge of the critical requirement of each use for which wood seeks a market. Use requirements should be determined and made known in terms of wood properties. At present, only a certain few structural uses are held by wood by virtue of a precise definition or measure of the properties essential to the purpose. For the other hundreds of uses there are almost no specifications based on technical facts, or substantiated by scientific tests, and the material is chosen according to a wide variety of opinion and prejudice. Under such circumstances whatever technical knowledge is obtained about the properties of wood is not effective as it might be in bringing about better wood utilization, because the consumer has not evaluated his own needs in equally exact terms.

Builders, for example, do not know where to specify decay resistance in buying wood for house construction, because they do not know what the moisture and temperature conditions are that permit decay fungi to grow or where these conditions are liable to exist in houses in the various climatic regions. The decay hazards in construction work through the United States should be scientifically determined, so that the use of nondurable or untreated wood may be avoided in these places.

Another unknown use requirement so far as wood is concerned, is the exact moisture content to which it should be dried before being placed in use. This is different for different uses. Moisture content at the time the word is put into use has a great deal to do with serviceability. In house construction alone, moisture content if left out of consideration is liable to cause plaster cracks, open joints in floors, trim and siding, warping and buckling of wood panels, poor fits in doors and windows, misalignment of locks, deformation of plumbing, loss of nail-holding power, poor floor levels, blistering of paint, poor insulation, loss of rigidity, and attacks of decay and fungus stains. Wood dried to the moisture content that it will normally have in service causes least trouble through change of size and form while in use.

Past research in the design of wooden boxes and crates has been largely instrumental in bringing American containers and packing methods in foreign commerce from recognized inferiority to recognized superiority. Hundreds of shippers have sent representatives to short courses of technical instruction in box and crate design, and are now carrying forward an organized program of their own to apply the principles of improved design throughout their industry.

In the same way the available data on wood properties should be applied to the fundamental design problems of other fabricated articles including house construction. The recent hurricane in Florida, for instance has disclosed a need for better anchorage of roof rafters to house walls, and better anchorage of frame houses to foundations, in order to get a maximum resistance to wind storms. Experimentation is needed to show home builders how to obtain maximum heat insulation in wooden house walls, floors and roofs.

Closely allied to such design utilization problems is the need for technical development of certain materials, such as glues, binders, preservatives, finishes and metal fastenings. Research should assume the task of developing more economical and more effective wood preservatives. It should find cheap liquids for diluting preservatives so as to obtain adequate depth of penetration into the wood without the use of excessive quantities of toxic material. It should investigate ways of producing more cheaply certain promising organic preservatives, and it should investigate the intermediate by-products of nickel, cobalt, and copper refining to find in them if possible a cheaper wood preservative.

There is also a great need for a more durable and more water-resistant glue for use with wood. The present water-resistant glues, although they will stand a great deal of abuse, are not entirely waterproof, and on exposure to severe conditions they will ultimately give way. Further, the woodworker takes great pains to dry his lumber carefully and bring it to the proper moisture content for working with a minimum of trouble. In the glue room much of this tedious work is undone by putting back into the wood a large amount of water along with the glue. Not only must time be taken to dry the wood again, but many of the tantalizing difficulties of the woodworking factory have their origin in the swelling and shrinking resulting from glue moisture. The ideal glue that research will one day bring to light will contain no water and possibly no volatile liquid at all; it will be as permanent as the wood itself.

Another distinctive field bearing very directly upon waste elimination and cost reduction has to do with improved production processes. Take, for example, the inevitably increasing use of the "portable" or small sawmill with the contraction of timber stands which is throwing a large part of the lumber industry back a century or more in the development of its manufacturing technique. Private stumpage owners, as well as foresters, vitally need to know what equipment is best suited to each type of cutting operation, how to obtain greater precision in sawing, how to reduce saw-kerf waste, how to increase the yield, and how to saw for grade. Seasoning losses are exceptionally high at the smaller mills, and it is important both to improve their air-seasoning practice and to adapt the dry kiln to their small-sized output.

There is a further need to determine much more accurately than is now known what sizes of trees pay their way in logging operations and which might better be left to grow. A study already made in the hemlock and hardwood region of the Lake States has brought out the fact that trees below a certain diameter are being logged at a loss, and might better be left for logging with a future crop. Such studies should be comprehensively undertaken for each of the great producing regions. Coincidentally, the dimension-stock idea, or the shifting of the work of cutting various parts of wood products to exact size from the factory back to the sawmill, needs further development. The promise it holds in the way of saving freight on waste, achieving more precise manufacture, and utilizing present mill by-products are of sufficient economic significance to warrant a systematic attack on the problem.

Another important and allied opportunity in the woods waste field is the enormous losses from breakage in the felling of large timbers. Preliminary work has already shown not only a startling variability in general practice, but that by the application of already known mechanical principles, breakage losses sometimes aggregating over 30 M. feet per acre may be materially and economically reduced. Such studies combined with a closer knowledge of the size, form and quantity of current logging wastes in typical regions will lay the foundation for the reclamation and profitable use of a vast amount of wood.

A further field of growing significance, because of its bearing on the utilization of waste from the woods, mill, and factory, is the conversion of wood into chemical and fibrous products. While it does not concern all timber owners, it must increasingly concern many of them.

Most of the new uses of wood that are discovered in the future will be of a chemical or fibrous nature, and most of them will consequently be such as can employ wood in relatively small sizes. The pulp and paper, distillation, and naval stores industries are of outstanding importance in this respect. Unsolved problems which will govern the timber owner's markets for his material in these industries are mostly in the field of widening the species and form of raw material which can be economically utilized. In the paper industry, this means the perfection of new processes, such as the new semi-chemical pulping processes, which promise to yield at low cost, and with low consumption and wide variety of wood, pulps that are suitable for cheaper grades of print papers and for special fiber bonds possessing exceptional stiffness; determining the pulping value of both hardwood and softwood mill and woods waste by the semi-chemical or other new processes; and producing a strong white pulp from the pines.

In the naval stores industry, this means the determination of the smallest size of longleaf and slash pine trees, both virgin and second growth, that it is profitable to turpentine; the proper chipping method to use in turpentining trees over a long period, to obtain the greatest yield of gum with the least injury to the tree; an accurate determination of the amount of degrade in lumber caused by the turpentining of virgin and second growth pines; and means of telling, in advance of chipping, the high-yielding from the low-yielding trees.

A further field for chemical research lies in the increasing applicability in industry of cellulose esters for such products as lacquers, artificial silk, and adhesives, requiring ever increasing quantities of cellulose material. In place of cotton and purified wood pulp, the bulk of the raw material might come from the wastes of the lumber trade as sawdust, slabs, shavings, and perhaps bark. Research has already indicated the possibility of changing wood into transparent lacquers to be used as finish coatings on wood and other materials. Such research might also lead to the ideal non-aqueous glue which woodworkers need. Similarly, there is a chance of chemically modifying the surface of sawdust particles so that they will adhere together, thus making sawdust its own binder in the manufacture of insulating boards and molded products. Great possibilities lie ahead of the wood cellulose chemist in the production of such new industrial materials.

One further phase of the problem requires particular attention, and is of direct concern to foresters as well as timber owners. It pertains

to properties of the material, and progress toward their future control during the growing period.

Opportunity for the control of wood properties begins in the forest. If adequate attention can in the future be given to the control of growth conditions, it will not be necessary to redetermine the properties of each succeeding crop of trees. This is even now a complication that must be dealt with, for the second growth material that is now being marketed is different from virgin growth. Research has made a good start in associating the distinctive properties of certain woods with the conditions under which they grew, and this study should be carried out as fast as possible for all woods, for industry will soon have to take, or reject, what silviculture produces.

To grow more wood is not enough. To grow high-density wood, low-density wood, straight-grained wood, trees with the correct taper for poles, wood without shakes, wood with few knots, decay-resistant wood, wood of low resin content, wood with high resin yield, wood without pitch pockets, wood easy to paint, easy pulping wood—these are problems requiring an answer if the timber owner and grower of the future is to achieve his ultimate possible success.

Fortunately, timber owners and lumber producers are awakening to the far-reaching significance of forest products investigations to the permanent stabilizing of their markets and to the success of their activities. Their present trade extension plans, involving co-ordinated expenditures of over $5,000,000 are tangible evidence of their growing interest. But in the last analysis, the success of their extensive plans depends upon a foundation of knowledge, largely not yet available. To get this knowledge—to get it thoroughly, comprehensively, quickly and to get it understood and effectively applied—is of critical importance. It is likewise essential to the far range future of the forestry profession, which depends so largely upon the forests of private owners.

What is now significantly needed is assurance that research is to go forward in a scale broad enough to assure wood its rightful place in the first rank of dependable industrial materials of the future.

GIRDLING OF HARDWOODS TO RELEASE YOUNG CONIFERS

By H. L. Churchill

Forester for Finch, Pruyn & Co.
With an Introduction by Austin Cary

Introduction

Several considerations seem to call for an introduction to Churchill's paper and by the present writer.

In the first place, when the editor of this journal some months ago proclaimed that foresters were doing far more talking than befitted their deeds, Churchill came to mind as one among a number of men who, if the facts were known and duly appreciated, would largely balance the account.

Secondly, Churchill names me in his article. Our acquaintance indeed is of long standing, having begun during his student life; in fact I named him for the position he now holds, and of late years I have been in frequent touch with him.

Third, since Churchill went with Finch, Pruyn and Company seventeen years ago, he has, as it seems to me, played the real forester's part, achieved the ideals of the profession more nearly and directly than any other man of whom I can think in any such field. That is as I size things up admittedly. If, however, anything like it is true, it is worth the while of members of the profession to learn what he has done and something of how he did it.

In 1910, the company named was sawing lumber and operating a newsprint paper mill at Glens Falls on the Hudson. They owned something like 100,000 acres of land. This was well located and of good character, but believed to be entirely inadequate to support the business permanently. A permanent business, in paper particularly, they thought should be a good thing; also they felt it ought to be practicable if they went about it right. Having reached that conclusion and resolved to act on it, though they had plenty of good woodsmen of the ordinary type at command, they thought the right kind of a forester ought to help them.

That was the situation in 1910 when Churchill took hold. Today Finch, Pruyn and Company own around 250,000 acres of timber land

tributary to their plant, and this area, the sawmill having been shut down, technical study has indicated should be sufficient to perpetuate the paper business as they conduct it. These lands have been put under an effective map system; they are so efficiently protected that no serious fire has occurred since Churchill went in. The woods business of the company, logging and driving, is very efficiently conducted. They mark their timber before cutting, have planted some, are studying, as Churchill's present paper shows, all practicable means of keeping their lands productive. This, in the judgment of the company's executives, is good business throughout and the standing of the company confirms this opinion. Furthermore, it is not only actual forestry but for the time and conditions, it meets every implication of the term. Under the company's executives Churchill has been the chief agent in all this development.

The how of it is no less interesting and instructive. In this direction limits befitting this article will cause me to be very brief. I wrote more at length in the *American Lumberman* for September 11 last, and Churchill himself had a paper in the International Number of the *Pulp and Paper Magazine* of Canada for February 1927. These articles are earnestly commended to the members of the profession, the younger ones particularly, whose ambitions or interests run at all along this line.

It would have been easy indeed to queer the job. A merely technical or advisory relation to the company's business would likely have done that; it has at various times elsewhere. So also would missing the real point: the company's business interest as represented in forestry. Right there an idea comes up that is believed to be worthy of the closest attention. I have been with Churchill several times in the last few years in the woods and in the office, and this is the impression I get of a man studying first and all the time for his employers' interest, not trying in the first line to demonstrate any theory or set of ideas through them. That may be fundamental; I rather think myself it is in respect to getting along comfortably and to actual achievement.

Churchill secondly seems satisfied with his job, to be himself on its level. In the woods much, up and down the Hudson in his car, driving trades or making logging plans in the office, he seems comfortable and satisfied. He is not hankering for the white lights of the

city nor is his mind distracted by things that however interesting do not concern him, West Coast timber affairs and the developments of scientific forestry, for instance. Not meaning to convey the idea that he does not keep up with the times or would not be quick to respond to an idea or situation of material bearing. I mean to say that he is not distracted by outside things, also that he is a woodsman still. In other words and briefly, one might say he is truly a forester.

Caution, a thrifty cast of mind, and self-control are other evident personal characteristics of Churchill. These traits inspire general confidence in employers. Also they have been usefully manifested by Churchill in the work he has done for them, the order in which he took up one thing after another. There again a point is reached that may well be pondered upon by men in circumstances at all similar. When he first went with the company, studies of growth and a "working plan" were things the heads of the company had in view, and how easy it would have been, what an attractive field of effort it opened to the forester, to fall in with that! Churchill did not do it. After looking things over he told his employers the time was not ripe for it, that he himself was not fully equipped, that other courses were more insistent. Instead, therefore, he went to protecting and organizing their lands, to looking after their logging work, to the timely and responsible task of buying more land when opportunity offered. Just in the last few years, however, with pressure on these lines relaxed, those earlier ideas have been reverted to, and Finch, Pruyn and Company have prosecuted, and are now prosecuting, as thorough-going technical work as the profession can plan and in all the volume that seems to be called for. And how much more it is worth in these circumstances!

But one more point will be taken up—Churchill's reaction to his education. Calls indeed have been made on him during his career that have put him to his trumps, that led him to see that the best training available is none too good for the line of work he follows. Much of that, however, he believes can only or best be acquired through experience, by an active and well equipped mind meeting the calls that arise successively. Of the set education which he had, I understand his judgment to be this—that his theoretical forestry training, though not elaborate, was sufficient; that more training in engineering lines would have been of great service to him.

So much on the specific case. How about it in general? I must

be very brief here and assume agreement by the reader on most points. To my thinking, the lines in which timber growing for the nation's needs shall proceed in time to come have cleared up vastly in the last few years. It appears, for one thing, that large scale corporate and individual enterprise will do much of the work required. The following article by Churchill refers to the best example of that thus far, an enterprise carried through to a certain point in a satisfactory and successful manner. The combination of American business men and an American forester has done this thing, and it heartens and encourages. As for the forester in the case, granting that variations may occur and still be effective, isn't it true that if more men had been available of just his type, more achievements of this kind would be in evidence today.

AUSTIN CARY

GIRDLING OF HARDWOODS

When raw materials of any kind for which there is a big demand begin to run short, there is always considerable and increasing effort put forth to find new supplies. Business men may have been mildly interested in the matter for a long time but when they see the need pressing for something with which to keep their plants going in the immediate or even distant future, they begin to act as well as to think.

To the pulp and paper manufacturers who are also owners of pulpwood-producing lands, anything that can be done at a reasonable cost to materially increase the annual growth of wood, ought to be of more interest than buying additional lands to protect and pay taxes upon. Moreover, new areas conveniently located cannot always be purchased.

For a considerable number of years I have noted with interest what was taking place in various sections in the Eastern Adirondacks, and in Maine and New Hampshire, where hardwoods were being cut on various small areas for fire wood or local log supplies, and other local uses. I noted that where the stand had been nearly pure hardwood, such as beech, birch, maple, ash, and others, dense reproduction of the same species had followed immediately. This reproduction grew so rapidly for the first two or three years, especially the maple and white ash, that what few small softwood seedlings might have been on the ground were effectually choked out. On many areas, however, where the stand of old hardwoods had been rather open, a large number of young spruce and balsam were growing underneath

but not making rapid headway. On such parcels, removal of the scattered old hardwoods caused the young softwoods to shoot up so rapidly that it was conspicuously noticeable and it "got the jump" on even the young maples. In some cases, where all the old trees were removed at once, young spruce and balsam were killed or injured from the sudden exposure.

Of course, we have all read and talked more or less about releasing young growth. Yet it was not until 1925 that I ever really attempted to make any study of the matter with the idea of actually doing anything about it.

About this time Austin Cary brought up the same matter with me. Also Edward S. Bryant talked about trying out the cutting of white and yellow birches in the spruce slope type, where such trees were evidently damaging and hindering the growth of small spruce.

In 1925 we decided to make some practical tests to determine the actual cost per acre under somewhat varying conditions and thus to find out on just what areas it would pay to do such work.

With a crew of five men and a two chain tape I laid out several test areas with a radius of two chains, or covering about one and one-fourth acres each. These plots were large enough so that the results obtained could be considered as applicable to the type in general. They were so located as to cover some areas upon which there were only a few hardwoods, and others where there were 150 or 160 large maple, beech and birch on a plot, or about 110-120 per acre, which seems to be about the greatest number that will permit a fair amount of softwood reproduction to get started underneath.

A strip of bark, six inches to one foot wide, was removed completely around each hardwood tree that was suppressing coniferous reproduction. This work was done during the peeling season (May, June and July). I carefully timed the men doing this work, to determine the time per plot and per tree, and also the relative time per tree for expert axemen and green men. The average time per tree was two minutes and five seconds, but the best axeman girdled a few more trees than the two green men.

The average time per acre with between fifty-five and sixty trees girdled, was just about two hours for one average man. Of the seventy hardwoods, four inches to twenty-four inches in diameter, on what might be called an average acre, the expert axeman would girdle twenty to twenty-two, two fair men fifteen each, and two green men

ten each. Naturally, as the work progressed, the green men became more proficient but, generally speaking, a good axeman is born, not made, and it was very evident that this work could be done at a materially lower cost by employing first class men only, even with the considerable difference in wages paid.

Two methods of girdling were tried out; one removing a strip of bark around the tree, as described above, and the other cutting a shallow kerf or notch completely around the tree. The depth of this notch depends upon the force of the blow struck and the condition of the axe, but by delivering one blow with the bitt slanting down and the next slanting up from below to meet it, a chip is removed, taking out the bark and the outer layers of wood so that the flow of sap is pretty well shut off. This method costs slightly more than the other but can be done any time, and I believe kills the tree somewhat more quickly. This last may not be an advantage as a *gradual* removal of the cover is probably better than removing all the shade at once.

During the peeling season of 1926, several hundred acres were girdled. The average cost ran around $1.25 per acre, taking into account lost time. Late in the fall I decided to try out a somewhat more simple method during the season when the trees are frozen and dormant. This consists of just cutting around the tree once with a thin sharp axe, not taking out any chip but cutting downward at an angle of about forty-five degrees with a sharp blow, so that the axe cuts into the wood an inch or more. When the outer layers of wood are frozen hard the effect is almost like an explosion and not only is the wood opened up but a strip of bark flies off so that the tree is girdled the same as in summer. This works especially well on old beeches. One man girdled 132 trees in an hour.

If this work is done only on poor hardwood areas where a good stand of young softwoods is already established, that will mean girdling twenty-five to 125 hardwoods per acre with an average of perhaps sixty-five or seventy per acre. I believe that where there are more than 125 hardwoods per acre the results of girdling would be unsatisfactory as there is too little spruce on such ground and only hardwood reproduction comes in. Here the hardwoods are also of better quality and thus may have a value of their own. Naturally, where good hardwood trees are found, even on the spruce lands, they are not girdled. The idea of the work is to make five or six good trees grow

rapidly where one poor hardwood is not growing well and only cutting off the light and using up the soil moisture and food that might be increasing the growth of the spruce.

Up to February 1, 1927, we have spent on this work $1,965.00. We have girdled the poor hardwoods on a little over 1,500 acres, or about 107,500 trees, and releasing perhaps 550,000 to 600,000 young softwoods that should grow to pulpwood size. This is at a cost of about one-third of a cent per tree released. Should this land be cut as soon as the trees become merchantable for pulpwood; say, when it takes ten trees per cord; this cost would mean three and one-third cents per cord of wood cut. Even though half these trees were to die, the cost would be only six or seven cents. Without such release only a part of these trees will grow to pulpwood size, perhaps only one-third, and they probably would be twice as many years in reaching merchantable size.

What we have done thus far has really been in the nature of a large-scale experiment and has been rather expensive because we have not been running any camps and have been obliged to pay high prices for board. By doing the work entirely in the winter and having a regular crew with their own cook, or staying at logging camps, the cost ought to be somewhat less.

THE FORESTRY OF JAPAN

By W. C. Lowdermilk

Forestry may be studied to good advantage in Japan. Few nations present as good an example of the close relationship between the conditions of the mountain areas and agricultural lands. Forest areas are generally managed definitely with a view to national economy within Japan proper. Management is being extended to other parts of the Empire as well.

Japan proper is mountainous and volcanic. Less than 25 per cent of the land area lies at a gradient below 10°. The cultivated land, which has about reached the limit of extent, comprises a little less than 15,000,000 acres, only 16 per cent of total area. Of this a little more than one half, 7,500,000 acres, can be irrigated and is devoted to growing rice. The arable land is cultivated by 5,500,000 families, which averages less than three acres per family. Thus each acre is called upon to supply food for about four persons of the total population of 56,000,000. The rice paddy land is unequal to the demands for rice; the imports from Chosen (Korea) and Formosa must be

Note:—I wish here gratefully to acknowledge the courteous and kind assistance on the part of the members of the Department of Forestry, Imperial Ministry of Agriculture, and of the Government of Chosen (Korea), in my studies of Japanese forestry. Particularly am I grateful to Mr. Tomoaki Hirakuma, Director of the Forestry Board; Dr. Homi Shirasawa, Director of the Imperial Forestry Experiment Station, Meguro, Tokyo; Dr. Mikumaga Fujioka, Professor of Forest Utilization, Mr. D. Tanaka, Forest Engineer; Prof. K. Kominami, Professor of Forest Botany, Tokyo Imperial University, Dr. Sanroku Ichikawa, Professor of Forestry Imperial University of Kyoto, District Forester, G. Matsustiaka of Kyoto District, and Forest Officers Mr. K. Shimojo and Mr. E. Suzuki;

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To Mr. S. T. Sato, Forest Supervisor of Kin Sen Chosen;

To Mr. Tawchi the forest engineer in charge of erosion control reclamation and reforestation work at Kinsen, Chosen.

Being the only overseas delegate representing the science of forestry I am particularly mindful of, and grateful for the courtesies shown me on behalf of the Society of American Foresters.

supplemented with imports from alien shores. The increase of production of the agricultural lands as well as their maintenance in productivity becomes a primary concern of the government. This necessary policy affects forestry in a special way.

The assessed values of land are below the market price, but they indicate the relative if not the true marketable values of mountain and farm land.

TOTAL ASSESSED VALUES OF LANDS IN JAPAN PROPER

		Yen
Paddy (Rice) land	Farm	1,014,555,000
Upland	Land	227,882,000
Building land		633,516,000
Forest land		26,917,000

Forest land is assessed therefore at a value of 2.1 per cent of all productive land, excluding building lands. The value of standing timber is omitted.

Japan is poor in agricultural land area but is very rich in forests. They cover 48 per cent of Japan proper as against 53 per cent of Sweden. When Chosen (Korea) and Taiwan (Formosa) are included the portion of the area occupied by forests is raised to 63.5 per cent of the total land area. This is an unique position among the advanced nations.

The area of forest lands does not include the "Genya" or "treeless" wild lands covered with various weeds which may be utilized for grazing and may also be converted into forests. In Japan proper the "Genya" comprise 9 per cent of the land area. Of all Japan the "Genya" comprise nearly 10.3 per cent.

In Japan proper extensive planting is being pushed in the Genya areas. The present artificially established forests total an area of more than 1,618,600 (1886-1923) acres, of which about 8,000 is in bamboo, and are included under forest area. The plantings now in progress on the Genya comprise a big program, which is doubtless as large or larger than any planting program of Germany or France. It is a remarkable fact that a nation so replete with forests should be extending the forest area so energetically.

Despite the great area in forests, the imports of timber into Japan have been on the increase in recent years, particularly since the earth-

quake disaster of 1923. The imports from North America, which have consisted chiefly of Douglas fir ("Oregon Pine"), were as follows:

TIMBER IMPORTS FROM NORTH AMERICA

In Cubic Feet

	Cubic Feet
1920	7,677,930
1921	27,230,940
1922	61,441,150
1923	62,575,850
1924	98,963,030

The total imports of 1924 were 112,925,330 cubic feet at a value of 119,392,707 Yen, as against total exports of 13,676,016 Yen.

Imports of timber into Japan are in great part to be explained by differences in logging and manufacturing costs. The great volume production by machinery of northwestern America places lumber on the market across the Pacific at a lower cost than the less accessible timber supplies of Japan can be logged at the present time. The result is that Japan is building up a reserve of timber supplies for the future, whereas America is exploiting her reserves.

FOREST TYPES

The forests of Japan may be divided into four broad forest zones, namely, subtropical; evergreen broad-leaved forests; deciduous broad-leaved forests; and coniferous forests.

The subtropical zone includes the lower elevations of Formosa up to 2,000 feet in the south and 1,500 feet in the north. The upper altitudinal limits of the zone descend northward to sea level on the southern boundary of Japan proper. The mean annual temperature of this zone exceeds 21° C.

The evergreen broad-leaf forest zone lies above the subtropical zone. The upper limit of the zone inclining northward descends to sea level in the southern part of Honshu at 36° north latitude. It reaches an elevation of about 6,000 feet in Formosa. The characteristic species include camphor (*Cinamomum comphora*) and evergreen oaks *Quercus acuta, Q-supp.* and *Pinus densiflora.* The mean annual temperature of this zone lies between 13° and 21° C.

The deciduous broad-leaf forest zone envelops more land area than either of the other zones and contains the larger part of the

economic forests of Japan. The upper altitudinal limit of this zone lying above the other zones descends to sea level in the middle portion of Hokkaido. From this line it ascends to 1,500 feet in southern Hokkaido; 4,500 feet in the Ou district; 6,500 feet in Shikohu; and 10,000 feet in Formosa.

Dominantly characteristic species are both broadleaves and conifers. Among the hardwoods are *Fagus Sylvatica L. Var. sieboldii Maxim., Zelkova acuminata Bl,* and *Acer balmatum Thunb.,* which is responsible for so much of the glorious colorings. The conifers include the famous "Sugi" or *Cryptomeria japonica Don., Chamaecyparis obtusa Set Z.,* and *Larix leptolepis.* The mean annual temperature ranges between 6°-13° C.

The coniferous forest zone merely touches the higher mountain peaks in central Japan and envelopes northern Hokkaido, Sagalien, and the Kurile Islands. The mean annual temperature falls below 6° C. The extensive northern forests of Sagalien comprise chiefly *Picea ajanensis Fisch., P.—Glehni Mast,* and *Abies sachalinensis Mast.* The forests of northern Korea belonging also to this zone, include *Pinus korainensis* and *Larix dehurica Turcz.*

Growing Stock

The total growing stock of Japan's forests is placed at 88,535 millions of cubic feet with an average stocking of 966 cubic feet per acre. The per acre stocking ranges from 490 cubic feet in Korea, where much of the forest land was wastefully and carelessly denuded during the late Yi Dynasty, to 1778 cubic feet in Formosa where little exploitation has taken place. The average stocking of central Japan, where intensive management has been practiced, is 1036 cubic feet per acre. This figure approximates, therefore, the normal growing stock, and indicates a cut of approximately double this amount each rotation.

The rotation is widely varied, according to the objects of management, from 30 years for poles to 100 years for timber and even longer for special large sized timbers.

Annual Growth

The average annual growth in central Japan may be placed at approximately 50 cubic feet per acre. This figure is roughly based on the present growing stock with an assumed average rotation of 100 years and with allowance for intermediate cuttings. This figure is

checked with growth data which are reported from the following localities in Japan:

	Yields per acre per annum
Conifers at Hokkaido	70 cu. ft.
Cryptomeria, Central Japan	84 cu. ft.
Hardwoods, Central Japan	42 cu. ft.
Pine (good quality) Southern Japan	70 cu. ft.

Forest Ownership

The ownership of forests is fortunately well distributed.

OWNERSHIP OF FOREST AREA BY PERCENTAGES

	Per Cent
Imperial family	3.2+
State	50.7+
Communal	10.5+
Shrines and Temples	0.8+
Private	34.7—
	99.9+

The Forest Act of Japan

The Forest Act of Japan—Act No. 43, April 23, 40th year of Meiji (1907) Revised by Act 75, June, 44th year of Meiji (1911), is of special interest to foresters. An English translation was provided for the Pan Pacific Congress by the Department of Forestry. Only a few features of special interest can be noted here.

A "forest owner" is defined as a person who by any right can make use of or profit out of land for the purpose of owning trees, bamboo, or a forest. A local governor may, if it is deemed necessary, require public corporations or temples to prepare working plans for their forest areas; the said plans to be approved by the governor. Likewise the governor may alter such working plans if it is deemed necessary. If forests under any ownership are threatened with devastation the governor may indicate the methods of working such forests. If a person cuts in such a way as contravenes the methods indicated, cutting may be stopped and reforestation required.

The competent minister may, in the following case, include a forest among protection forests:

(1) When a forest is necessary for protection against soil denudation;

(2) When it is necessary against shifting sand;

(3) When it is necessary for protection against damages from floods, winds, or tides;

(4) When it is necessary for protection against avalanches or rolling stone;

(5) When it is necessary for the regulation of the water supply;

(6) When it is necessary for fisheries;

(7) When it is necessary for guiding navigators;

(8) When it is necessary for public health;

(9) When it is necessary for the scenic beauty of a shrine, a temple, or a noted place or historical site.

The cutting of trees, the use of forest litter, stones, and other uses of a protection forests are under the direction of the competent minister. In some cases a private owner may be compensated for losses sustained in being deprived of revenue from his forest.

Forest Co-operative Societies

Forest Co-operative Societies may be established within definite areas and scope,

(1) "When it is necessary for the maintenance of the safety of the land or for the prevention of the devastation of forests or for the reforestation of devastated forests.

(2) "When it is difficult to accomplish the object of utilization of forests except by a co-operative working because the forest is owned by different owners.

(3) "When the co-operation of the persons interested is needed for the purpose of starting or maintaining construction works necessary for the transportation of forest products from the forest.

(4) "When the co-operation of the persons interested is needed for the purpose of preventing the dangers and damages of their co-operative society."

"A forest co-operative society is a corporate juridical person not established for profit."

The forest co-operative society is of particular interest, since it provides for the inclusion of a large number of small ownerships into a forest management unit. Small ownerships lead to unwise and irregular cutting. Combining small areas into manageable units becomes a very important improvement in conservation. Likewise the

government may deal directly with the co-operative society more advantageously than with a large number of small owners. This method of combining what otherwise would be unmanageable units into a manageable whole deserves especial study. The idea may be adapted to a wide number of conditions in other countries, more especially China.

Forest Education

The progress of forestry in Japan is credited largely to the spread of forest education. The spread has been rapid since the founding of the first institution of forest education—the Tokyo Forest School—in 1881. Within the 45 years the schools have increased to 53 in number, of which four are of university grade, ten are special schools ("ranger schools"), and the others are of industrial or prefectural school grade. The graduates from these schools numbered in 1925:

University grade	672
Special Schools	2,268
Prefectural Schools	4,056

Forest Research

The technical experiments in forest problems are carried on at and under three forest experiment stations. One is located in Formosa, another at Meguro near Tokyo, and the third at Seoul, (Chosen). Research is amply provided for with generous budgets. The two last named stations were visited by the writer. Experts are added to the staff to carry forward scientific investigations into each branch of research which is undertaken.

The investigations are grouped under the following heads:

1. *Silviculture,* under which studies are made of the forest soil and its relation to forest tree growth. The factors influencing natural reproduction, fixation of sand dunes, the restoration of eroding lands.
2. *Forest utilization and products.*
3. *Forest management,* involving studies of the treatment of forest stands upon yield and other factors.
4. *Forest Protection,* involving studies on injurious animals, insects, and other factors on the forest. Special attention is being paid to the development of parasites for the injurious forest insects. At the Chosen Experiment Station special studies are being made of the parasitism of the pine defoliator *Dendrolimus spectabiris, Butler,* a poisonous hairy caterpillar which is very destructive to pure pine forests. [This insect has been doing enormous damage in China, where, in re-

cent plantations of pure pine, extensive areas are seriously damaged. Thus far no method of control has been devised beyond the actual collection and destruction of the caterpillars.] In Chosen alone 735,000 acres of pine forest are very seriously damaged annually.

5. *Forest Meteorology:* Forest meteorology has received special and systematic attention in Japan. The control of waters can not be separated from the management of forests where 78 per cent of the land area is mountainous. The steep topography and heavy rainfall yields a heavy stream discharge through the numerous short rivers to the sea.

6. *Forest and Field Culture* (Waldfeldbau). The intermixture of agriculture and grazing as well as burning is a subject of study, which has yielded convincing results.

7. *Tree Seeds and Miscellaneous:* involves studies of tree seeds, the influence of the location and kind of parent tree upon the seedlings.

Publications

The results of experiments are published in bulletins of the Forest Experiment Station in scientific journals and in other ways. Abstracts of many of these investigations were published in English for distribution to the delegates of the Pan Pacific Science Congress.

Forest research therefore plays a very important part in forest practice and policy. The large area of state and Imperial forests makes possible a wide application of these findings. Methods of management involving the results of research are also extended to the communal, temple, and co-operative association forests and to some of the private forests of Japan proper.

Summary

Forestry in Japan has received full attention as one of the basic enterprises in national economy. It is fostered in its aspects as a profitable business and as a regulator of the highest uses of soil and waters. Withal the forests play a leading rôle in the national recreation, in satisfaction of the appreciation of the beautiful, and as a medium of culture. Japan would lose her charm and her prosperity; her people would be reduced to wretchedness and calamities far beyond the damages of all earthquakes, were the mantle of forest vegetation to be removed from the steep slopes and bold mountains. The present policies recognize this and are committed to a wise, well rounded program of forest, water, and soil conservation.

FOREST SURVEYS IN SWEDEN

Results of the Recently Completed Inventory of Norrland's Forests

By Erik Östlin

Forestry Fellow—Sverige Amerika Stiftelsen, 1926-27

Norrland (Northland) in northern Sweden is comprised of some 60,000,000 acres which lie north of the Dal River and make up 54 per cent of the total land area of Sweden. An intensive forest survey of this region has recently been completed by the Swedish Government foresters. The following figures give the land classification of this huge tract as determined by the survey.

	Per Cent
Farming land	3.2
Absolute forest land	55.5
Bogs (non-productive)	17
Land above timberline	23.0
Other waste land	1.3

Thus, we see that Norrland is primarily a forest country. An idea of what is on the forest land can be obtained by studying the following tables showing the distribution of site classes, the density of the stands, the age classes, and the general forest condition.

Site is determined by height over age tables. The following abstract for site class VI will give some idea of the tables used for pine in Norrland.

Site VI	Age in years	20	40	60	80	100
	Height in ft.	5	17	30	37	42

Site class VI has a "normal" producing capacity of 35 cubic feet per acre per year. The difference between site classes is 25 per cent, i.e., site VII will produce 0.75 x 35 or 26 cubic feet per acre per year.

ABSOLUTE FOREST LAND IN NORRLAND BY SITES

Site	I-II	III	IV	V	VI	VII	VIII	IX
Area in per cent	0.1	0.9	7.8	27.9	34.3	18.7	7.7	2.6

From the above figures it will be seen that about 80 per cent of the forest land is comprised of sites V, VI, and VII, capable of producing, respectively, 49, 35, and 26 cubic feet per acre per year.

The use of the term, density, often leads to confusion, for its determination in the field is a matter of personal judgment. According to the Swedish definition, density 1.0 exists when the stand, with consideration to its age and to the species, fully utilizes the timber-growing capacity of the site. Thus, density 0.5 would mean a stand which is utilizing only one-half of the productive capacity of the site. Density 1+ indicates that the stand is being retarded in growth by overstocking.

DENSITY OF FORESTS ON NORRLAND'S ABSOLUTE FOREST LAND

Density	0.0	0.1-0.2	0.3-0.4	0.5-0.6	0.7-0.8	0.9-1.0	1+
Area in per cent	0.9	4.7	13.5	31.1	29.8	16.4	3.6

From the table we find that four-fifths of Norrland's absolute forest land is covered with stands having a density of 0.5 or more. About 5.6 per cent of the forest land is in need of reforestation (density below 0.2), while 3.6 per cent is overstocked and badly in need of thinnings.

AGE CLASS DISTRIBUTION

Age in years	1-20	21-40	41-60	61-80	81-100	101-120	121-160	161+
Area in per cent	6.5	11.5	17.4	15.0	9.3	7.8	11.9 (2 classes)	15.0

From this table it will be seen that there is an over-supply of stands about 40-80 years old and also of the oldest stands, while there is a lack of stands about 100 years old and also of the very young ones. The policy for the next decades will be to manage the cut in such a manner that no lack of mature timber will occur. Such a happening would, of course, be a great calamity to Sweden which depends so much on her forest products for her annual income. Some of the mature timber of today must be held over until the trees 40-80 years old can fill the gap.

The general condition of the stands was expressed in terms of good, fair, or poor. The different grades show to what extent rational forestry is being practiced, due allowance being made for the locality and its economic situation.

The survey shows that the condition is good, i.e., good forestry being practiced, on 44.3 per cent of the forest land, fair on 37.8 per cent, and poor on 17.9 per cent.

Some reasons for classifying a stand in the poor class are as follows:

1. Wrong cutting method, as, for example, if only the best trees have been cut and the poor ones left.
2. Too low density or overstocking.
3. Wrong species growing on the site.
4. Neglected reforestation.
5. Unusually large amount of dead and injured trees.

The Government's forests and those of the large companies are being managed in an efficient manner, while the survey showed that the farmers' forests were, as a general rule, poorly managed.

The figures and tables given in the preceding pages pertain to area distribution and have been worked up from the record sheets of the leaders of the survey crews. The following data are compiled from the tally sheets of the field crew.

Sixty thousand sample trees of spruce, pine, and birch, ranging in d.b.h. from zero to eighteen inches (2 inch classes), were intensively studied. The notes on these sample trees will be of utmost value for future investigations.

TABLE SHOWING NUMBER OF TREES OF FOUR INCHES D.B.H. AND OVER

		Per cent of total
Pine	1,912 million	32.6
Spruce	2,697 million	46.0
Birch	1,249 million	21.4
Total	5,858 million	100.0

The total volume (peeled) is about 27,500 million cubic feet. The spruce forms 12,000 MM or 43.7 per cent; the pine 10,500 MM, or 40.8 per cent; and the birch, 5,000 MM, or 15.5 per cent. The economical value of the latter is very low. More than 50 per cent of the volume of each species, including birch, lies in the d.b.h. classes between 4 and 8 inches.

The forests, as they were surveyed, were classified as to maturity.

Maturity Class I—young and middle-aged trees of thrifty appearance. (Cutting limited to thinnings.)

Maturity Class II—mature healthy trees. (Can be cut now or in the near future.)

Maturity Class III—very old or damaged trees that would decrease in value if allowed to remain. (Should be cut at once.)

TABLE SHOWING CUBIC VOLUME IN THE VARIOUS MATURITY CLASSES

	Maturity Class	*Per cent*	*Volume in MM cu. ft.*
Pine	1	49.6	5,200
	2	29.7	3,100
	3	20.7	2,200
Spruce	1	43.9	5,300
	2	30.0	3,600
	3	26.1	3,100

The figures above show that conditions are not entirely satisfactory. In a well managed forest, the ideal would be to have as little as possible of the volume in maturity class III.

The increment per cent growth for pine is 2.78 per cent and for spruce 2.66 per cent. On a per acre basis for pine and spruce combined, this gives an annual increment of 18.4 cubic feet.

COST AND SPEED OF WORK

The average distance of strip, 33 feet wide, cruised per day was 3.5 to 4 miles. On level ground and in poorly stocked country, the distance sometimes increased to 6 miles, while in densely forested areas with small sized trees it dropped as low as 2.5 miles.

The cost per strip-acre was about $2. If the lines were 6.2 miles apart (1 Swedish mile), or .1 of 1 per cent cruise, the cost per area-acre was only 0.2 of a cent.

The cost of computing was about $1 per strip-acre. The total cost was, thus, $3 per strip-acre and, at 4 acres to the strip-mile, the cost comes up to $12 for a mile of strip.

In regard to organization of the crews and field procedure, reference is made to E. J. Hanzlik's description in the JOURNAL OF FORESTRY (vol. 23, pp. 395, 1925).

In conclusion, it can be said that the survey has shown forestry conditions in Norrland to be better than was expected. The cubic volume was found to be 47 per cent higher than anticipated, yet most of this increase lies in birch trees which have little commercial value so far north. The absolute forest area was almost 2 million acres larger than official estimates had placed it. The conditions of the stands, however, indicate that there is much work to be done. It is hoped that when the forests in Norrland are under the best form of management, the returns will be approximately doubled.

REVIEWS

The Chemistry of Wood by L. F. Hawley and Louis E. Wise. American Chemical Society. Monograph Series. pp. 334. Chemical Catalog Co., Inc., New York. 1926.

This book is one of a series of monographs sponsored by the American Chemical Society which marks a new departure in endeavoring to found an American literature of applied chemistry without primary regard to commercial considerations.

This monograph represents the first attempt to assemble and review under one cover the purely scientific aspects of the chemistry of wood. It entailed the appraisal, abstracting, and interpretation of the work of some 400 investigators—an exceedingly ambitious undertaking, considering the complexity of the problems and the diversity of the opinions involved. It should prove invaluable in furthering researches in this rapidly growing field. The authors have held strictly to the chemistry of wood substance and have not attempted to indicate the application of the data to industrial uses.

Wood is a heterogeneous substance with which most industrial and research chemists have dealt in its entirety. Very little has hitherto been published of the chemistry of the botanical elements of wood, which is nevertheless of the utmost importance to the biologist, the forester, and the industries. The authors point out the incompleteness, at best, of present knowledge in this respect. The book is devoted largely to an account of researches on the chemical composition of cell structure, although the extraneous components of wood (tannins, resins, dyes, oils, gums, alkaloids, etc.) that bear prominently on certain wood uses are covered thoroughly and interestingly.

While the forester who has no knowledge of chemistry will find the text difficult in places, he will not have to read all parts of it critically to grasp the significance and importance of this extensive field of research with respect to the production and marketing of timber and other forest products. He will see large possibilities of modifying or extending the usefulness of wood properties, thereby enhancing the value of wood—always provided that the composition of the elements can be clearly determined and properly correlated with other physical and biological factors.

The cellular structure of wood is built up of cellulose and lignin in the approximate ratio of 60 to 30, with perhaps 10 per cent of other

materials. But so little is known of the chemical composition of even the two major constituents that few specialists in the field can so much as agree on a definition of them. In separating them by chemical means, largely empirical, there is no sharp dividing line between components, and the reaction products are difficult to trace to their sources because of their heterogeneous occurrence in the wood substance.

The skill and ingenuity being applied to these problems is extremely interesting to the forester, the botanist, and the wood technologist, and the methods and deductions used by the chemist will doubtless give new angles of approach to many questions in their respective fields. The method employed by plant physiologists for identifying cellulose and lignin by staining is declared unreliable by the authors, who point out that the color reaction which lignin alone is supposed to give may also be obtained from essential oils. Within the last year it has also been demonstrated that the middle lamella—the partition between cells upon which the cell-wall substance is built by the plant—is made up entirely of lignin and not of pectin, which for years has been commonly regarded as the lamella substance. This is the first botanical element in wood structure that has been definitely isolated and identified by chemical methods.

The chapter on extractives considers a number of experiments that illustrate the importance of wood chemistry to forestry and wood utilization. While the extractives of wood remain obscure in origin and biochemical significance, they are often the means of identifying closely related species. *Pinus ponderosa* and *Pinus ponderosa scopulorum,* for instance, are quite dissimilar in oleoresins. *P. ponderosa* and *P. Jeffreyi* are similar in appearance, but they can easily be classified by the chemist since the former contains N-heptane and the latter does not. Extractives, although they are easily removed by solvents and are not considered a part of the wood structure, are responsible, in part at least, for many of the properties of wood, such as durability, color, weight, hardness, and shrinkage. Recent investigations indicate that silicates (formerly considered an extractive) may be an integral part of the cell wall. A sort of siliceous skeleton in the form of longitudinal rods that has been observed in fibers and tracheids may account for the much smaller longitudinal than transverse shrinkage of the cells in drying.

Impossible as it may be at present to determine the origin and components of various botanical elements of wood, analysis of the total for comparative purposes by standardized methods can be used

advantageously in the interpretation of certain biological phenomena. Such analyses have furnished valuable information on the effect of decay in wood and the chemical changes wrought by marine borers and termites, and they will probably furnish additional information of importance to the entomologist, ecologist, and silviculturist when the various branches of natural science are properly correlated. The analytical differences between springwood and summerwood, heartwood and sapwood, hardwoods and softwoods, and the proximate analyses of many species are shown in convenient tabular form in Chapter 6.

The chapter on combustion of wood bears directly on the characteristics of wood as a construction material exposed to fire hazards, as well as on its value for fuel. The discussion of the mechanism of combustion of wood offers a lead for the investigation of the forest fire problem from a new angle.

A discussion of the probable sources of distillation products, as related to the chemical components of the elements in wood, is offered under the chapter heading "Decomposition of Wood by Heat." A most interesting deduction is that during thermal decomposition of wood there is a stage when the mass is plastic, it having been demonstrated that by applying mechanical pressure the original structure of the wood may be obliterated from the charcoal and that the charcoal can be given a different fracture from that which would obtain if the pressure were not applied.

The hydrolysis of wood, the process by which commercial ethyl alcohol is obtained, is discussed with the purpose of indicating the reactions on the known constituents and pointing out the proper direction for further research. The present reviewer gets the impression that hydrolysis is the reverse process of photosynthesis, and that we may arrive at an understanding of the latter by means of this and other processes of decomposition.

The various methods used to separate lignin from cellulose in the manufacture of pulp are discussed in the chapter "Delignification of wood." In the past, before any considerable knowledge of the chemistry of wood had been attained, chemical pulping processes were supposed to separate lignin from the wood without the decomposition of cellulose; but that they are never completely separated and that the cellulose is never left completely intact is made clear from the experiments described. Even now all too little is known of the reactions involved in the several commercial processes for pulp-making, and a better understanding of them will be followed by the rapid develop-

ment of new commercial products from wood. Incidentally, the problem of stream pollution by sulphite liquor discharge would be much easier of solution if the composition of lignin were definitely determined.

The structural and chemical nonhomogeneity of wood accounts for wide variations in its physical properties. Not only do its mechanical properties differ in different directions, but they vary also with specific gravity, rate of growth, proportion of springwood to summerwood, the part of the tree from which the wood comes, moisture content, and other factors. In fact, wood varies in many of its physical properties much more than in its chemical properties. Strength, for example, is affected by moisture and heat which have little effect on chemical properties. Nevertheless such properties as penetrability, specific gravity, conductivity of heat, expansion, and moisture absorption are discussed from the chemical point of view as thoroughly as present knowledge warrants.

If the values inherent in wood are to be enhanced through control of properties, a rationale of the properties must be achieved. The most important of all properties of wood is its propensity to swell and shrink with moisture changes, and hence the control of moisture changes would add tremendous economic values to our forest output. The movement of water through wood is discussed under the heading "Absorption of water," and theories of movement by capillarity and vapor pressure are analyzed.

The last chapter of the book, "Deterioration of wood," the reviewer found one of the most interesting. Wood would last almost indefinitely if it were not exposed to fungous attack. Fungi attack wood by means of enzymes, which the chemist has reason to believe break down the lignin and cellulose into chemical compounds soluble in water and alkali and corresponding to intermediate compounds in the chemical disintegration of the wood. As to the relatively low durability of sapwood as compared with heartwood, a somewhat puzzling contradiction of common belief is the demonstration that the sugars and starches contained in sapwood (which supposedly furnish foods for fungi) are in reality the substances least attacked. Directly, natural durability of wood is due neither to differences in wood structure nor to the presence or absence of starches or sugars, but to the relative quantity of toxic extractives. Careful tests have demonstrated that heartwood is more durable than sapwood because it contains a larger amount of such extractives, which prevent fungi getting a start;

in resinous wood it is probably the volatile oils from the resin that are the toxic agents. Indirectly, however, the structure of wood may have an important bearing on durability, for some woods (such as the red oaks) originally possess toxic material which rapidly leaches out, whereas others (as the white oaks), with extractives no more toxic, are much more durable because the extractives are more tenaciously held in the wood.

EDGAR F. WHITE

Veneers and Plywood. E. Vernon Knight and Meinrad Wulpi, editors. The Ronald Press, New York. 1927. Pp. 372, Illustrations 193, and bibliography.

Veneers and plywood are old products, but they have in recent decades come into greater prominence than ever and, with built-up products, bid fair to crowd lumber as the dominant product of the tree. Foresters should be particularly interested in this development.

Long as this book was in making its appearance, it is a credit to a branch of the lumber industry that is awake to its opportunities. The veneer industry did not wait for the appearance of a voluntary academic book, but boldly set out upon the task of appointing editors and collecting the data. If the reviewer recalls correctly, it was to have been a contribution of the veneer industry, but evidently the final preparation and publication was left in the hands of the editors. The book may leave much undone in the way of being a text or guide to the mill employe who needs information on detailed steps or veneer making, handling and use, and it may lack much in the way of orderly presentation, but it will be a useful reference book and text to those who know little or nothing about veneers and therefore want to learn the essential steps from log to finished product.

In the preface the editors give the aim of the book as "the setting forth of the facts, both historical and technical, relating to the origin and present-day production of Veneers and Plywood. It is designed for the student and teacher in the industrial arts, the prospective purchaser of furniture, the salesman who wishes to be thoroughly well-informed on his merchandise, as well as for the economist and purposeful reader in general."

The book is in three parts. Part I deals with the history of veneers and plywood, and takes up nearly one third of the text. Part II is brief, forty pages, and deals with the properties, advantages and utility of veneers and plywood. Part III is on "The Manufacture of

Veneers and of Plywood." The student seeking information on the making and use of veneers may be disappointed to find such a large space devoted solely to historical applications of veneers. The historical part, however, is well done and makes very interesting reading. The editors found veneering to date back to the time of the Third Thotmes, and portraits of an inlaid chair of the Fourteenth Century B.C., and of a veneered coffin of the Twelfth Dynasty, are presented. Pliny's Chapter on Veneering is reproduced, and the exquisite marquetry and veneered furniture of the later French, Jacobean, Queen Anne, and Georgian periods is described and beautifully illustrated.

In Part II, the editors discuss the utility of veneer, the origin of the name, the superiority and advantages of plywood, as well as its engineering aspects.

Part III is the practical man's portion of the book. Here he will learn of the several methods of manufacturing veneer, the machinery required, the preparation of the veneer for its assemblage into plywood, the glues used, kiln drying, storage, etc. This part was undoubtedly the objective of the projectors of the book, and it should have been the strongest. It is rather badly arranged, and in some places the compilers failed to consult the most reliable sources. This part discusses also the woods used for veneers, kiln drying, specialty uses of veneers and plywood, marquetry and specifications. It is excellently illustrated with half tones and line drawings. The twelve page bibliography will be a valuable aid to other investigators.

E.F.

How a Tree Grows. By William Somerville. 212 pgs., 112 illustrations. Oxford University Press (American Branch), 1927.

This book is the outgrowth of a series of lectures given to forestry undergraduates in Oxford. Prof. Somerville's long experience as a teacher probably in part accounts for the interesting style in which it is written. The book is well illustrated and the text is brief, clear and concise.

The reviewer recognizes that in a book of this nature it is impossible to emphasize too many exceptions to any general rule. Yet certain errors are made which can not be excused on this basis.

Prof. Somerville (p. 78) makes the same error so commonly made by American foresters in considering Gymnosperms and conifers as synonymous. The statement is made that, "It is well to remember that some conifers, e.g., the Maidenhair tree, have broad

leaves." The Maidenhair tree is, of course, a Gymnosperm, but it is not ordinarily classed among Coniferales, but rather placed in a separate order, namely the Ginkgoales.

On page 99, a statement is made to the effect that the absence of starch is also a cause of the improved durability of the duramen, because starch is a fungous food and its absence, therefore, creates conditions unfavorable to the life of wood-destroying organisms. Workers* at the Forest Products Laboratory showed several years ago that this theory is incorrect.

In his discussion on the relationship of ringbreadth to quality, the author has not clearly distinguished between ring and diffuse porous woods. The casual reader may therefore reach some erroneous conclusions.

In the reviewer's opinion, the most outstanding deficiency of the book is the lack of any consideration of photosynthesis. Any discussion of how a tree grows is obviously incomplete without a consideration of this interesting and important biological process.

There are other statements made to which the individual reader might take exception, but on the whole the book is well worth the time required to read it. It should be especially interesting to foresters in the "older age classes" who wish to review the general question of tree growth in a brief, pleasant way.

H.S.

Forestry in Denmark. By Axel S. Sabroe. The Danish Forest Society, Copenhagen, Denmark, 64 pages.

This little book is packed full of pertinent information about Danish forests and forestry. It is primarily a guide book. As such, it is a great aid to a forester from another land in determining what there is in Danish forestry that is of particular interest to him and where and to whom he may go to get more detailed information along the lines in which he is interested. It contains brief but relatively complete descriptions of the Danish soils and climate, silvicultural and management practices, utilization and marketing conditions, laws affecting the practice of forestry, etc. One point of particular interest brought out in one of the tables is that the forests occupy a greater

* Hawley, L. F., Fleck, L. C., and Richards, C. A. The relation between durability and chemical composition in wood. *Indust. Eng. Chem.* 15: 669-675, 1924.

portion of the total land area in the most densely populated, best agricultural districts than they do in the poorer, less densely populated agricultural districts (10 per cent for the "Islands" as against 7.9 per cent for Juteland). Another interesting point is that only about 32.5 per cent of the total forest area is publicly owned, while more than a third of the privately owned forests are in ownership of less than 150 acres each. The silvicultural utilization operations on these forests require, on the average, 2.63 days' labor per acre per year for the "Island" forests and 2.00 days' labor per acre per year for the Juteland ones. The annual yield increased from 201 cubic feet per acre per annum in 1878 to 255 cubic feet per acre per annum in 1910 for the "Island" forests and from 154 cubic feet to 191 cubic feet per acre per annum for the Juteland ones. In 1923-24 the yield was about the same as in 1910. Between 1915 and 1919 there was extensive overcutting, particularly in 1917-18. The average annual net income obtained from the thirteen normally stocked State forests, calculated on the gold basis, was $2.82 per acre in 1911-15, $18.66 per acre in 1918-19, $1.20 per acre in 1920-21 (the bottom of the post-war depression), and $4.48 per acre in 1923-24. (These forests again being operated under approximately normal conditions.) These changes in net income have been due almost entirely to changes in the prices received for the products marketed rather than to variations in the volume of the cut, although the high income received in 1918-19 is partly due to the excessive cutting taking place in that year. In spite of the intensiveness with which its forests are managed, Denmark imports four-fifths of its softwood requirements and considerable amounts of hardwoods.

J.H.A.

British Bark-Beetles, by J. W. Munro, Forestry Commission, Bulletin No. 8, pp. 77, text-figures 26, and 10 special plates.

Munro's recent bulletin entitled *British Bark-Beetles* is a well arranged and well written treatise of a subject that has been hitherto somewhat neglected in the British Isles. In this publication he has done for the British Isles what Swaine had already done for Canada. In this bulletin the available information concerning British bark-beetles is summarized and brought together in usable form. The first two chapters are occupied by a general discussion of bark-beetle biology and the importance of these insects in forestry. Chapters three and four deal with the structure and taxonomy of the group. In his dis-

cussion of control measures he very properly emphasizes the importance of prevention and points out that the danger of bark-beetle outbreaks is in inverse ratio to the intensity of forest management.

In an appendix he has added a list of British bark-beetles arranged according to host plant. This is a useful aid to foresters who may be unfamiliar with the species of bark-beetles that should be looked for on the various species of trees. A bibliography of sixty-eight titles and a series of excellent plates follows. This will be a very useful publication particularly for British foresters.

S.A.G.

India's Forest Wealth. By E. A. Smythies (India of Today, Vol. VI) pp. 137. Oxford University Press, American Branch, New York. Price $1.25.

Within the covers of this little book there is packed away, in very readable form, a large amount of information concerning the Indian forests, especially their composition (Chapter IV), their relation to agriculture (Chapter III), their past history (Chapter II), and their future possibilities (Chapter VI). The author is one of India's foremost foresters.

The forest lands of India and Burma, under the control of the Forest Department, amount to about 160,000,000 acres, or a little more than one fifth of the total area of these countries. Of this area, only about 68,000,000 acres is permanently reserved for timber production and only 45,000,000 acres is under intensive management. Yet the average annual gross income received from these forests (1919-24) was about $17,900,000 and the average annual net income for the same period was about $6,000,000. These results have been achieved in spite of the poor quality or condition of a considerable portion of the forest area under administration, of the inaccessibility of much of the best timber, and of the giving away each year to the agricultural population, forest products worth at least $5,000,000. Dr. Vodcker, in his report on Indian Agriculture, published in 1890, says that forestry came just in time to save Indian agriculture through its provision of fodder and fuel reserves for the peasants. These forests also furnish part time work to thousands of peasants and forage for about 12,000,000 animals. In addition, they furnish nearly all of the timber products used in India besides about $12,000,000 worth of timber, mostly teak, for export.

The purpose of this book is to furnish concise information concerning the extent and present economic importance, especially to agriculture, of these Indian forests, and also to impress upon the reader the fact that the development of the forests has only begun. What possibilities for greater economic good to the nation may be locked up in these forests! With the coming of adequate transportation and the development of uses for the hundreds of species that are now classed as worthless, the effective productivity of the nation will be tremendously increased. This little book brings these possibilities forcefully to one's attention.

J.H.A.

NOTES

Schlich Scholarship

The committee on the Schlich fund met in London on June 30 to consider the use to which the fund may best be put. The committee decided to devote the fund to the establishment of a forest scholarship, tenable at Oxford, and open to the English speaking peoples.

Three points on which the committee has not yet reached a decision are: (1) Should the scholarship be given to undergraduates attending the Oxford School of Forestry, or to men who have already graduated in forestry and wish to come to Oxford for one year's post graduate work? (2) The manner in which the scholarship should be awarded. The committee felt that it could be best awarded in rotation to a man from Great Britain, the British Dominions and Colonies, and the United States. (3) The method of selecting a man each year.

The committee is asking for suggestions on these three points. Without speaking for the profession as a whole, the Journal volunteers some comments.

The scholarship should be open to graduates from forest schools who wish to come to Oxford for a post graduate course. The foundation in forest training of a forester, it is believed, should be laid at a forest school in the country in which he is to work. A young man with training in forestry will be able to derive greater benefit from attending a forest school abroad than an undergraduate; he will know best the things he wants to learn and what will be most useful to him in his later career.

The rotation plan, suggested by the committee, between Great Britain, the British Dominions and Colonies, and the United States, seems a splendid one.

The actual selection of the man should be left in the hands of the committee handling the Schlich fund but should be based upon the recommendation of a committee representing the profession in the country from which the man is selected. In the United States, the Executive Council of the Society of American Foresters may be entrusted with the task of making such recommendations at the time the scholarship is allotted to the United States.

These suggestions are thrown out merely as a basis for further discussion. The matter must finally be decided by the Executive Council of the Society.

A New Technical Journal in the Field

It is with great pleasure that we record the organization of the Society of Foresters of Great Britain and its official publication, "Forestry." We welcome this new society and its journal into the growing family of technical forestry organizations.

The Society of Foresters of Great Britain was formed in 1925 with the object to advance and spread in Great Britain the knowledge of technical forestry in all its aspects. The inaugural meeting was held at Oxford, August 1926. R. L. Robinson was chosen President, Prof. R. S. Troup, Vice President, and E. A. Galloway, 8 Rutland Square, Edinburgh, Secretary-Treasurer.

The Society's journal will be published annually in the first instance, but the number of issues per annum may be increased later. It will provide a means

for the publication of the results of practice and research, both in the growing of timber and in its utilization, including such basic sciences as forest physiology and ecology, forest soils, wood structure, and timber physics; and allied sciences, such as forest entomology and forest mycology.

The first number of the magazine shows "Forestry" to be published at the Oxford University Press, London, and having 139 pages of about the size of those in the JOURNAL OF FORESTRY, though with somewhat smaller type. Judging from the contents, "Forestry" promises to be a most interesting magazine. The following articles appear:

British Forestry. By R. L. Robinson. Sets forth the limitations under which the practicing forester in Great Britain works. Gives the 1924 census of woodlands for their country and some interesting trade facts about wood imports and home-grown products.

The Silviculture of Conifers in Great Britain. By H. M. Steven. Some interesting side lights are told of early importations of species from Europe and America and the species found most prevalent today with their silvicultural limitations.

Silviculture of Hardwoods in Great Britain. By W. H. Guillebaud. Gives the names of the common hardwood species and where the forests are found in Great Britain; also their description and the troubles encountered by over-thinning fungi, and rabbits.

Utilization of Softwoods in Great Britain. By John T. Smith. British importation of timber began about the 11th century, and today they import nine to ten times the amount they produce. It is pointed out that one of the few forms in which home timber is exported is in the form of packing cases filled with British manufactured goods. Examples are given of utilization in cutting and manufacture.

The Marketing of British Hardwoods. By J. H. Newnham. American tool handles and spokes now dominate the British market and the few firms left are those who have adopted American machine methods. Home-grown timber is in disfavor because of high price and uncertainty of quality, condition, and supply.

The Present Position of Forest Entomology in Great Britain. By J. W. Munro. Forest Entomology has only been recognized in Britain for 20 years. Some of their problems are described.

Forest Products Research in Great Britain. By Major F. M. Oliphant. A very interesting account is given of the newly established Forest Products Research Laboratory, located 35 miles out of London, and under the directorship of R. S. Pearson from the Dehra Dun Institute in India.

Aesthetic Considerations in British Forestry. By W. Dallimore. A plea to maintain the attractiveness of the British Isles' landscape, so admired by both foreigners and citizens.

A General Review of Post War Forestry in Central Europe. By Dr. Ing. Franz Heske, Vienna. Points out some of the changes in forest policy, silviculture, forest management and economics which have followed as the result of the war.

Some Recent Forest Research in Norway. By Erling Eide. Pine regeneration, growth and consumption studies, tree form and fungal problems are some of those mentioned as being worked upon in Norway.

Recent Forest Literature in Denmark. By Prof. Carl Mar: Møller. A very interesting survey of early forestry work in Denmark and its present activities.

Forest Research Work in Finland. By Dr. L. Ilvessalo. Gives a complete résumé of the forest research work in Finland with references.

Dauerwald. By Prof. R. S. Troup. Sets forth the principles of the Dauerwald idea and gives examples.

Some Factors Influencing the Increment of Forests. By R. N. Aldrich-Blake. A most worthy paper on physiology as applied to forestry. Gives 43 references to his discussion of the physiological criterion of increment, the rate of assimilation of raw materials, water and salt requirements of trees, respiration, and the factors influencing the rate of carbon assimilation.

A Critical Note on Some Recent Literature on Forest Economics. By W. E. Hiley. Gives an account of the present state of the post-war controversy on soil rental, and indicates the lines along which useful progress has been achieved.

The Oak Mildew Microsphaera Quercina (Schw.) *Burrill* and *Armillaria Mellea* (Vahl.) *Ouel. in Relation to the Dying Back of Oak. By W. R. Day.* A discussion of the work being done on the dying back of oak, which is perhaps the most serious forest disease at the present time in Europe.

An important feature of the new journal are the reviews. Seven publications have been reviewed in this issue.

From this brief account of the contents of the first number of "Forestry," it is clear that the journal aims to cover the field of technical forestry in Great Britain and other countries with a breadth of vision and an appreciation of the scientific phases of it. With the present flood of popular literature on forestry, it is refreshing to see a new technical journal devoted to a serious consideration of the problems of forestry, irrespective of whether they strike the popular fancy or not. Without such serious magazines, the profession tends to become shallow. It augers well for British foresters that they willingly assume the burden and monetary sacrifice that is involved in a publication of this character. The American foresters will greatly profit by becoming constant readers of this new journal. Far from considering it a rival of the American Journal of Forestry, we welcome it to our ranks and will share with it in the struggles for greater recognition of forestry all over the world. The new publication is of particular interest to American foresters because, as its Editor states: "The new British Society, which has charge of its publication, is based largely on the Society in America, and there should be close contact between the British and American societies to the benefit of each."

The Use of Planimeters in Forest Mensuration

L. R. Reineke
Office of Forest Measurements, Forest Service

The planimeter is a labor-saving instrument which has seldom been used in forest mensuration for other than the determination of land areas. This method of determining map and graph areas is without a peer and its use wherever data can be represented by the area of a graph will usually effect a considerable saving of time and effort.

A few of the uses to which the ordinary planimeter may be put are listed below:

1. Measurements of areas of plots, burns, types, etc.
2. Determination of tree volumes.
3. Determination of total or average values from drum-type recording instruments, such as recording thermometers and hygrometers. (With a special type of planimeter, known as the "Universal planimeter," similar values may be obtained from circular recording charts. The "Universal" type can also be used for all work for which the ordinary type is suited.)
4. Checking the fit of frequency curves.
5. Determination of plot values, etc., from graphs (frequency diagrams) of tallies, with basal area, cubic or board foot volume, or value, by size classes, as the ordinate, and number of trees in each size class, as the abscissa.
6. Measuring area of leaves. (Place leaf under celluloid.)

Other uses will suggest themselves, and the possibilities of this little instrument should not be overlooked.

A complete understanding of the theory of the planimeter is not essential to its adaptation to various types of work. It is sufficient to know that the instrument will measure the area of any regular or irregular plane figure, and can therefore be used to determine the total of any factor which can be represented by a plane figure.

Handbooks prepared by the makers of planimeters give both mathematical theory and practical use. "The Compensation Polar Planimeter," (F. S. Lib. No. 58.5 Ot8) prepared by F. Weber and Company of Philadelphia, is a clear, concise treatise on the subject.

The accuracy of a planimeter can be reduced by improper handling. For the most successful use the following points should be observed:

1. *Do not touch the beveled edge of the steel roller with the hands under any circumstances.*
2. *Do not turn the roller while it is resting on the paper.* If it is desired to set the roller to zero, first lift it off the paper and set it approximately. Make the final adjustment by moving the pole.
3. Handle gently: lift both tracer arm and pole arm when placing on or removing from the paper, to remove all strain from the hinge joint. Do not bend the tracer point.

Certain positions of the planimeter with respect to the figure to be traced give better results than others. The best results are obtained when the following conditions are met:

1. The pole should, whenever possible, be placed outside the figure.
2. The pole arm and tracer arm should be approximately at right angles when the tracer point is at the center of gravity of the figure and the pole is on the longest axis of the figure.
3. With very small areas the pole should be placed so that the angle between pole arm and tracer arm will always be slightly more than 90 degrees as the figure is traced.

4. The starting point should be taken at a point where the roller slides but does not turn. Then, if the starting and finishing points do not coincide exactly the measurement will not be affected.
5. A straight edge should *not* be used. A misplaced straight edge will introduce an error, while freehand tracing of the outline will permit compensation of errors.

If the above points are observed in using planimeters, highly satisfactory results may be obtained.

Weather as a Factor in Southern Pine Beetle Control

J. A. Beal
Assistant Entomologist, U. S. Bureau of Entomology

One of the most characteristic features of the epidemics of the southern pine beetle is their phenomenal rise and disappearance. The causes of such rapid decline have been attributed in part to excessive rainfall (1) or to low winter temperatures (2). Hopkins attributes the sudden decline of the great West Virginia outbreak to the severe freeze in the winter of 1892-93. Later, however, Craighead states that the excessive rain of the late summer and fall of 1892 may have been more influential than the low temperatures.

During the past winter (1926-27) there was a very heavy and general brood mortality of the southern pine beetle in the vicinity of Asheville, N.C.

This mortality may be attributed to a combination of factors, namely, low temperatures or temperature fluctuations during January and excessive rains of the fall of 1926. Records for both November and December of 1926 showed an amount of rainfall above the normal. One unusually cold period occurred on the 15th and 16th of January 1927. The following table gives the temperature variations for a short period on either side of the cold wave.

Temperature variations for January 1927, Asheville, N.C.

Date	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Max. temp.	39	42	24	21	35	40	44	23	37	44	49	57	66	72	70	73
Min. temp.	25	24	17	14	7	25	23	5	2	21	35	40	52	59	50	48
Daily range	14	18	7	7	28	15	21	18	35	23	14	17	14	13	20	25

The stages and condition of beetle broods were followed very closely during the entire winter. The brood in all stages remained in healthy, normal condition until after the heavy freeze of January 15th and 16th. Up to this time larvæ of all ages remained alive in the moist cambium layer between the bark and the wood. A few eggs could be found along the adult tunnels. Pupæ, adults and mature larvæ were overwintering in their pupal cells in the outer bark.

(1) Craighead. *Journal of Economic Entomology,* Vol. 18, No. 4. 1925.
(2) Hopkins. *Bull. 56, West Virginia Agricultural Exp. Station,* 1899.

An examination of the broods on January 20, only five days after the first severe cold, showed that, almost without exception, the larvæ between the bark and the wood had been killed and were turning brown. Broods overwintering in the bark had fared better and still appeared normal at this time. The only apparent difference between the outer bark and the phloem was a difference in moisture content. There was much more moisture in the inner layers where the larvæ were noted as killed. Had less moisture been present, the low temperature might have been less effective.

At the time of the January 20 examination it was thought that the adults, pupæ, and larvæ overwintering in the bark had escaped injury, but apparently it was simply a question of a slower death. A month later it was difficult to locate any of the broods and by early April no living beetles in any stage could be found. The reason for the delayed death of that part of the brood occupying the outer bark is not yet clear.

It should be noted from the table that conditions changed from near summer temperatures to near zero in less than 24 hours and that following the cold period, even higher temperatures occurred within a few days. Extremely warm weather occurred throughout the remainder of January and also during February.

During a warm period in February the beetle eggs which had been observed with the other brood and which of course were not expected to develop, hatched and the tiny larvæ began feeding and tunneling short galleries. These larvæ which hatched during the winter have thus far (May 7) been developing normally and promise to reach maturity about the middle or last of May. Apparently they will constitute the only survivors of a brood of overwintering beetles which it was thought would emerge this spring by the millions. These survivors represent a very small percentage of the original brood.

It will be interesting to note the abundance of the southern pine beetle during the coming summer. Seasonal conditions unusually favorable for the beetles may entirely offset the good effects of this mortality. On the other hand with more or less normal conditions this high mortality may be effective in preventing multiplication of the beetle to injurious proportions.

The Swedish "Better Sires" Campaign of 1904

James L. Averell

Fellow of American-Scandinavian Foundation 1926-27

Interesting proof of some of the points brought out in Bates' recent article on the importance of seeds' origin are found in Sweden. The amount of space in their forest publications devoted to this question of origin during the past two decades, only proves how much another forest country has been struggling with the same problem and has apparently come to a definite conclusion. The question is, must America also go through a twenty year "teething period," learning that which other foresters have already advanced.

During several trips last summer, the Swedish foresters explained the sad-looking appearance of stands in their areas as due to foreign seed being used. Such stands, with microscopic increment or with trees of poor form, were

all the more outstanding when they were adjacent to normal-growing, healthy-appearing stands from native seed.

As early as 1904 the importance of geographic origin of forest seed was written about. Hundreds of pounds of seed were being purchased each year from German seed dealers and used in reforesting Swedish clear-cut areas. The German *Pinus sylvestris* seed was cheaper than the Swedes could gather it from their own Scotch pines. On most of the areas, the trees grew normally for the first twenty years. But soon after this, tree after tree began to die, until the entire area had to be cleared and replanted. Other batches of seeds produced healthy trees but possessed a form that was far from desirable. Still others grew so slowly that it was a question if it would not be better to clear-cut and start again with the faster growing native seed.

By 1910 the situation had become obviously serious. Swedish companies were still attracted by the cheapness of imported seed and were diluting their own seed supply for planting, with that which they imported. It was necessary to lay an import tax of six kroner ($1.62) per kg. on the pine seed, and all foreign seed brought into the country had to be sprayed with red eosin dye as a warning mark of its origin. It was found that 8 gms. of eosin, dissolved first in a little water and then in 1 liter of alcohol did not influence the germination to any extent, yet branded it as foreign.

Attention was thus forced on the home grown seed. They discovered that even this was not always successful. Seed grown in southern Sweden with its mild climate and brown soil was not doing any better when planted in the cold Norrland with its "podsol" than German seed had been able to do. Detailed observation showed two distinct varieties of Scotch pine habitated within Sweden. The *Pinus sylvestris* of south Sweden did not have the slim form and the thin branches which the Norrland Scotch pine had (P. *sylvestris* v. *lapponica*) and on the other hand, neither did this south Sweden pine have the large-limbed, broad form of the German sylvestris to the south. It was thus clear that origin of seed was not an accidental question and must be given consideration.

Experiments have been conducted in regard to weight and size of seeds as well as the effect of the mother tree's age on production of good seed. It has been found that 1000 seeds of large weight and volume increased the number of seedlings obtained on germination, but after four to six years such seedlings appeared no better than those obtained from seeds of less density and size. To determine the age of tree best suited for producing good seed, plants were grown from seed produced on seed-trees varying in age from 40 to 150 years. No special age class stood out as being superior. However, the few markedly poor results were obtained in the oldest age classes, while the several batches of seeds which seemed the more successful were in the 40-50 year group.

Efforts have been made to divide the country into climatic zones, based chiefly on temperature, as the humidity is high in most every part. It was thus hoped to determine localities which could safely exchange seeds, whenever one of them had a poor seed-year. This scheme has proven rather difficult to apply and the most approved method is to collect seed and plant in each locality during its own seed-years.

For a number of years, records have been kept of observations on annual seed production. Each national forest is recorded as to whether it has a "good

medium or poor" seed crop as determined by observation on trees in stands and open grown trees. These data are recorded annually on a map of the country and an effort made to correlate it with the year's weather conditions. So far, not much success has resulted in the way of predicting or explaining seed years.

However, the fact remains that today Swedish foresters are planting 15,000 pounds of seeds a year and are well aware of the importance of the seed's origin. Is it going to take America 20 years, together with interstate taxes on forest seeds, to realize the same thing—that origin as well as appearance determines the good seed?

Forest Meteorology in Japan

By W. C. Lowdermilk

Flood phenomena are of frequent occurrence in Japan. The area of land suitable to the production of rice is seriously insufficient. Phenomena, therefore, which in one way or another reduce the extent or render sterile the rice paddies become a menace. The ancient proverb which goes "To rule the river is to rule the mountain" contains the policy which scientific forest management has found necessary to follow.

Consequently the climate and weather conditions of the mountain areas have been systematically studied by the establishment of well placed field meteorological stations which supplement the stations located in the plains by other agencies.

The effect of altitude and mountain masses on rainfall has been studied. The maximum fall of rain occurs on the mountains in a belt of about 500 meters between the altitudes of 1,100 and 1,600 meters. Both above and below this belt the rainfall decreased. Likewise comparative studies of various factors within and without the forest have been studied. Notable is the difference in rainfall which indicates the amount of rain intercepted by the forest canopy. Some of the results obtained are shown in Table I. The amount of rain which runs down the trunks of trees has also been measured. Reference is made for a complete account to the bulletins of the Department of Forestry, Forest Experiment Station, Meguro, near Tokyo.

Percentage of Total Rainfall which Reaches the Forest Floor Through the Forest Canopy

Mt. Mitumine; Altitude, 1,116 meters
Cryptomeria Stand about 180 Years Old

April	May	June	July	Aug.	Sept.	Oct.	Nov.
68	68	76	78	85	79	80	83

The effect of forests on run off has been carefully studied. The results agree with the common knowledge of the country that a forest cover plays an appreciable rôle in the control of run off waters. High water stages are not prevented. The first requisite in the control of the rivers, however, is to maintain the watershed in a cover of vegetation. The necessity of preventing erosion is even more realized in river control. The influence and efficacy of a forest cover on water sheds, particularly when the slopes are steep, a moot question in Japan.

It is so thoroughly established that forest and engineering policy are based upon this finding.

Papers on Forest Soils Presented at the International Soil Science Congress

Held in Washington, D.C., on June 13-22.
1927

H. Hesselman—Forest humus.
S. A. Waksman—Aerobic and anaerobic decomposition of oak leaves.
E. Melin—The mychorriza fungi of trees and their rôle in nutrition.
F. J. Alway—Effect of burning the forest floor upon the productivity of jack pine land.
F. J. Alway & C. A. Rost—Effect of forest fires upon the composition and productivity of the soil.
G. Kraus—Graphic representation of the results of numerous mechanical soil analyses.
G. Kraus—Variations in the calcium content of copper beech on various sites.
P. Albert—The mechanical composition of dune sands and its significance for the productivity of these soils in forests.
P. Albert—Application of the improved apparatus for measuring the resistance of soils to the determination of the structure of forest soils.
J. Kittredge, Jr.—The use of soil surveys in forest classification.
R. E. Neidig and R. S. Snyder—The cause of low productivity of soils in recently cleared coniferous timber lands.
Fr. Weis—Investigations on Danish heath soils.
Fred B. Trenk—The occurrence in Iowa of Hicoria in relation to soil type.
W. C. Lowdermilk—Problems in erosion and erosion control.
W. C. Lowdermilk—Factors influencing the surface runoff of rainfall.
C. G. Bates—Special problems to be met in the study of forest soils.
Raphael Zon—Silviculture as a factor in retaining the fertility of forest soils.
M. Westveld, P. R. Gast & P. W. Sickle—Notes on podsol profiles in the spruce forests of New Hampshire.
Raphael Zon & A. E. Wackerman—Control of water level in swamps to improve soil conditions and timber growth.

Erratum:

In the May, 1927, number of the *Journal,* Vol. 25, No. 5, on page 559, the figures 75 and 115 should be reversed. Actually 115 cubic feet corresponds with the 15 per cent and the 75 cubic feet with the 23 per cent.

J. Kittredge, Jr.

SOCIETY AFFAIRS

Revision of the Constitution

To Members of the Society of American Foresters:

Early in 1925 a committee was appointed by S. T. Dana, then President, to study the constitution of the Society and make such recommendations as it deemed desirable for its revision. This committee, under the chairmanship of E. H. Frothingham, has worked diligently on its task for over two years. It has solicited and received criticisms and suggestions from members and it has on several occasions discussed the subject with the Executive Council. The committee's effort has been directed to the recommendation of a constitution which will adequately and satisfactorily meet the growing needs of the Society. It is submitting the present draft of the revised constitution, at the suggestion of the Executive Council, not for formal action but that the committee may obtain more general comments and suggestions on the form of our constitution than has been feasible heretofore.

The Executive Council joins with the committee in requesting full and frank comment from the members, and wherever practicable from the Sections of the Society, on the form of revision now transmitted. The committee hopes to receive from these suggestions and comments material assistance in the preparation of its final draft for formal submission to the membership which it is hoped can be done this fall.

R. Y. Stuart,
President

Report of the Committee on Revision of the Constitution

The last general revision of the Society's Constitution was made in 1917. The voting membership was then 321. At the end of 1926 it was 1,225. In the debate upon questions of policy, finances, and organization which has gone on increasingly during these ten years of growth, it became evident that the Constitution was in need of revision in certain particulars and that a set of by-laws should be drawn up. Your Committee, appointed to this duty in 1925, has prepared recommendations for a comprehensive revision of the Constitution, which it submits herewith.

The Committee has consulted the constitutions of other societies and associations, and has considered many suggestions received from the members of this Society in past questionnaires. Before submitting its recommendations for ballot, however, the Committee believes they should be circulated to all members of the Society for criticism. Such criticisms will be regarded in framing the final report for action by the Society. It is hoped that such action can be taken this fall, perhaps early enough so that the next election of officers may be held under the new Constitution.

The preparation of the by-laws has been deferred since it will depend upon the action taken upon the Constitution.

Article I: Name

The name of this Society shall be Society of American Foresters.

The Committee favors omitting "the" before "Society."

Article II: Object

The object of this Society shall be to advance the science, practice, and standards of forestry in America.

Several inclusive statements of object were considered. The Council favors the above short statement, believing it more appropriate to provide for any expansion and interpretation of the object of the Society in a separate statement, such as that adopted by the Society last year.

Article III: Membership

The Committee recommends the division of Article III of the present Constitution so as to segregate the definitions, qualifications, and privileges of the various grades of membership from the matter dealing with procedure of nominations, election to membership, termination of membership, and handling of charges brought against members. The second part is placed under the proposed Article IV, Admissions and Terminations of Membership. The first part is contained in Article III, Membership, as in the present Constitution.

Section 1: The membership of the Society shall consist of Junior Members, Senior Members, Fellows, Associate Members, Corresponding Members, and Honorary Members.

The Council favored changing the present title of "Member" to "Junior Member," partly in order to make more clear the distinction between that grade and Senior Membership, and partly to avoid the present constant confusion between "Members" and "members." The sentiment at the annual meeting, however, appeared to be adverse to the term "Junior Member" on the ground that the grade is likely to contain a considerable number of relatively mature men, particularly those without forest school training, to whom the term is not particularly applicable, and also that the word "Junior" tends to minimize the importance of the grade. The Committee will be glad to receive suggestions as to a more suitable term than "Junior Member."

A new grade of Student Member was proposed by the Committee but was rejected by the Council on the ground that comparatively little advantage would likely be taken of it by the students and that it would complicate membership grades without accomplishing the object aimed at.

Section 2: Senior Members and Fellows shall be, at the time of their election, citizens of the United States, or its possessions, Canada, or Newfoundland. Junior Members and Associate Members shall be, at the time of their nomination for membership, citizens of the above named countries or shall have declared, in a legally accepted manner, their intention of becoming citizens.

A proposal to open up the membership to all North American countries including Central America was considered and rejected. With almost equal logic the membership could be extended to European countries. The differences in language and problems and the value of the Society in fostering solidarity among English speaking foresters with common ideals and viewpoints made it

seem unwise to extend the membership outside of the United States, Canada, and Newfoundland. Where occasion arises, corresponding membership can take care of Mexican or Central American, as of European foresters.

At the same time, the committee favors admitting to Junior or Senior grade foresters who are American or Canadian citizens, regardless of point of residence at time of election.

Section 3: Junior Members shall be graduates of a school of forestry approved by the Council; or in lieu of such training they shall show proof of at least six years' creditable experience in forestry or a closely allied field. If not engaged in actual forestry work, the candidate for election to this grade must show proof of having one of the two above qualifications and of retaining an active interest in forestry.

As a definition of what constitutes experience, the committee suggests the following for the by-laws:

One year of introductory or general courses in forestry or in subjects preparatory thereto, provided these are of collegiate grade, or one semester of junior, senior, or graduate courses in forestry at a technical school of forestry approved by the Council, shall count as the equivalent of one year of active practice.

Note that this does not require that the introductory or general courses in forestry must be taken at a forest or ranger school, and that it gives credit for courses in subjects preparatory to forestry, provided these are of college grade. The Committee felt that this is not only fair but would simplify matters somewhat by making a four-year course in forestry correspond to the six years of practical experience required of those without college training. Note also that actual participation in forest work at time of nomination is not a requisite provided the candidate can prove an active interest in forestry.

Section 4: Senior Members shall be elected from the Junior Members of the Society and shall have had at least ten years' experience in forestry. Advancement shall not be automatic but shall be based on demonstrated capacity to plan and execute important technical or scientific work in forestry. Senior Members shall be engaged in forestry work at the time of election.

Considerable discussion took place both within the Council and at the annual meeting of the Committee's proposal that all candidates for Senior Membership must first go through the grade of Junior Membership. The Council favored retaining this restriction but without requiring any definite period of apprenticeship in the Junior Membership grade, and this view seemed to be generally approved by the annual meeting. The minimum of ten years' experience in forestry required would make forest school graduates eligible after four years of active practice following graduation under the definition of "experience" given in connection with the above section, which would apply equally to this. Note, however, the provision that advancement shall not be automatic but shall be based upon demonstrated capacity.

Question was raised at the annual meeting as to excluding from Senior Membership men not engaged in forestry work at the time of election. The Committee believes, however, that the Society as a whole will favor this limitation as one means of preserving a high standard of active Senior Membership.

Section 5: Fellows shall be foresters of outstanding achievement as leaders in responsible directive or distinctive individual work of a fruitful character.

They shall be elected from the Senior Members, and shall be engaged in forestry work at the time of their election.

The essential change here is the omission of any provision for a minimum number of years of experience, which appear unnecessary in view of the high requirement as to achievement.

Section 6: Associate Members shall be persons not foresters who have shown substantial interest and have participated in the advancement of forestry, and who are generally known to the profession.

The revision omits the limitation "engaged in lines of work related to forestry" contained in the present version and adds the requirements that the candidate shall have participated in the advancement of forestry and shall be generally known to the profession.

Section 7: Corresponding Members shall be foresters who are not citizens or residents of the United States, its possessions, Canada, or Newfoundland, but who have shown substantial interest in American forestry. Professional qualifications for this grade shall be equivalent to those for the grade of Senior Member.

This maintains practically the present requirement for this grade, but adds that candidates for it must have shown substantial interest in American forestry.

Section 8: Honorary Members shall be persons not foresters who have rendered distinguished service to forestry either in America or abroad, and professional foresters of outstanding achievement whose field of work lies outside of the United States, its possessions, Canada, or Newfoundland.

This continues practically the present qualifications for Honorary Members. This and the preceding section would make the grade of Corresponding Membership for foreigners practically equivalent to the grade of Senior Membership for Americans, and the grade of Honorary Membership practically equivalent to that of Fellow.

Section 9: Junior Members, Senior Members, and Fellows shall be entitled to vote on any question before the Society as a whole, except that only Senior Members and Fellows shall be entitled to vote upon the candidates for Fellow. Other classes of members may attend any meeting of the Society and take part in the discussions, but shall have no vote.

It is proposed to restrict the vote on Fellows to the Senior Member grade because this is the grade from which the Fellows are elected, and because the Senior Members, due to their long experience in the Society, will presumably have the best knowledge of the candidates for Fellows and of their qualifications.

Article IV: Admissions and Terminations of Membership

Section 1: All admissions to the Society and advancements from the grade of Junior Member to that of Senior Member shall be by vote of the Council. Eight affirmative votes of the Council shall be necessary to admit any candidate or to advance any Junior Member. At least one month prior to action by the Council, the names of all candidates proposed, with a statement of their qualifications, shall be referred to the entire voting membership for comment or protest.

This Section replaces part of Section 2, Article III, of the present Constitution, differing chiefly in that eight, instead of seven, votes of the Council are required to elect a candidate or advance from Junior to Senior Membership.

This was believed desirable on account of the proposed increase of the Council from ten to eleven members.

The Committee's proposal for reinstatement, by unanimous vote of the Council, of members previously dropped from the Society, was opposed by the Council, which felt that the proper course for rejoining the Society should be by re-election in every case. The Council also opposed a provision that a unanimous vote of the Council should be necessary to re-elect anyone previously dropped from the Society.

Section 2: Nominations for all grades of membership except Fellow shall be endorsed either by a section of the Society or by three voting members, and shall be submitted in writing, with complete evidence of qualification, to the secretary-treasurer.

This proposed Section replaces part of the present Section 2, Article III. The only important change is the substitution of "secretary-treasurer" for "Member of the Executive Council designated In Charge of Admissions." As will be brought out later, the Committee questions whether any admissions officer will hereafter be needed, and even if he is, it questions whether he should be definitely provided for in the Constitution. It is expected that the items to be covered in making nominations will be specified in the by-laws.

Section 3: Nominations to the grade of Fellow shall be made by eight affirmative votes of the Council or by the written endorsement of twenty-five Senior Members or Fellows.

Substantially no change is made in the method of nomination of Fellows. The revision calls for the same number of votes for the nomination of Fellows as for the election of members.

Section 4: Advancement from the grade of Senior Member to that of Fellow shall be by letter ballot of the Senior Members and Fellows. An affirmative vote of three-fourths of those voting shall be necessary to elect.

The only change is in wording and in the segregation of this item from the other material in Section 1 (3), Article III, of the present Constitution.

Section 5: Charges of conduct unbecoming a member, when submitted in writing by five or more voting members to the secretary-treasurer of the Society, shall be investigated without delay by the Council. Final action shall be taken promptly but only after thorough investigation and after reasonable and specified time has been given the accused to prepare and submit a written defense. A vote of at least eight members of the Council shall be necessary to reprimand, suspend, demand the resignation of, or expel the member in question.

This Section differs from the present Section 3, Article III, chiefly in requiring that charges shall be submitted by five voting members, instead of "a member of any grade"; in specifying eight, instead of seven, votes of the Council as necessary for disciplinary action; and in the insertion of reprimand among the possible forms of discipline.

Section 6: Conditions under which membership is terminated, either by resignation or by non-payment of dues, shall be defined in the by-laws.

This would place in the by-laws the material contained in the present Section 3, Article X.

A proposed clause referring to reinstatement is automatically eliminated by the decision that all former members desiring to rejoin the Society must be elected according to the regular procedure.

Article V: Dues

Section 1: An entrance fee of $5.00 shall be assessed upon admission to the grade of Junior Member.

The Council was much divided upon the Committee's recommendation of an admission fee for Junior Members, but finally voted to approve it. The matter was not discussed at the annual meeting. The Council did not favor charging either dues or admission fees to Corresponding Members. Some of the Council Members favored charging an admission fee upon election to the grade of Senior Member, Fellow, and possible Associate Member. This was not, however, approved and was not discussed at the annual meeting.

Section 2: The annual dues of Fellows and Senior Members shall be $8.00, of Junior Members $6.00, and of Associate Members $5.00 In each case $4.00 shall be in payment of subscription to the official publication of the Society. Corresponding Members and Honorary Members shall not be charged dues.

The proposed dues for Senior Members and Junior Members are those which the outgoing Council has recommended that the incoming Council submit shortly for letter ballot. The need for an increased income has become so urgent, due to the greatly enlarged volume of Society business, that the passage of this proposed Section is the most immediately important end to be gained by these revisions. As to Associate Members, the Committee felt that it would be imposing no hardship to ask them to pay dues amounting to $1.00 more than the subscription price of the *Journal.*

The suggestion that Fellows be charged higher annual dues than Senior Members was discussed at some length but not approved. This question is well worth discussion, however, and it is hoped that comments will be forthcoming.

Section 3: Annual dues shall be payable on the first day of January. Entrance fees and dues of newly elected members shall be payable upon their acceptance of election to membership. Members elected after July 1 shall be charged half of the annual dues for the year. The Council may remit the dues of any members for any special reason as provided in the by-laws. No member of any grade shall be entitled to any return of fees or dues upon severance of his connection with the Society.

This contains no radical change from present procedure.

Article VI: Officers

Section 1: The officers of this Society shall be a president, a vice-president, and a secretary-treasurer.

The only change is to combine the present offices of Secretary and Treasurer. With a paid executive secretary, needed in any event, this combination can easily be made.

Section 2: The president and vice-president shall be elected from the Senior Members and Fellows as provided in Article VIII, and shall serve for two years from January 1, or until their successors are elected. The secretary-treasurer shall be appointed by the Council.

The principal changes from the present provisions are the extension of the terms of president and vice-president from one to two years and the appointment, rather than election, of the secretary-treasurer. The purpose of extending the term of office was partly to save the expense of an annual ballot and partly to give the administration of the Society greater continuity. The Committee saw

no reason for requiring that the secretary-treasurer should be a member of the Council and felt that the Council should be left free to appoint anyone qualified for the office. It also felt that no specified term for secretary-treasurer should be provided. It did not believe that the secretary-treasurer, if appointed from outside the Council, should be made a member of the Council, although he might logically be invited to sit in at most, if not all, of its meetings.

Section 3: The president shall preside at meetings of the Society, shall be chairman of the Council, shall appoint such committees as may be approved by the Council, and shall perform all other duties incident to his office.

Although the proposed Section differs somewhat in wording and inclusiveness from Section 3, Article IV, of the present Constitution, it is in entire accordance with present procedure.

Section 4: In the absence of the president, or in his inability to act, his duties shall be performed by the vice-president. In the event neither can serve, the Council shall appoint a president pro tempore.

This Section includes provisions inadequately taken care of in the present Section 4, Article IV.

Section 5: The secretary-treasurer shall be responsible for the keeping of the minutes of meetings of the Society, for conducting its correspondence, for announcing its meetings, for the custody of the records of the Society, which he shall deposit and expend only as directed by the Council, and for the performance of all other duties incident to his joint office.

This is merely a combination of Section 5 and 6 of Article IV, present Constitution, necessary if the offices of Secretary and Treasurer are united, as provided in proposed Section 1, Article VI.

Article VII: Council

Section 1: The Society shall be governed by a Council comprised of the president, vice-president, retiring president, and eight elected members.

This adds the retiring president as a member of the Council, a procedure which the committee thinks highly desirable.

Section 2: The eight members of the Council other than the president, vice-president, and retiring president, shall be elected from the Senior Members and Fellows as provided in Article VIII, Sections 1 and 2, except that the four elected members of the present Executive Council whose terms do not expire at the end of the calendar year in which this section is adopted shall continue to serve for two years from January 1 following its adoption. Four members shall be elected every other year beginning with the year in which this section is adopted, and shall serve for four years from January 1, or until their successors are elected.

The present Constitution provides a Council of ten—five officers and five other Council members, one of the latter elected each year for a five-year term. The purpose of the revision is to obtain a quicker overturn, shortening the term to four years. To conform with the plan of biennial elections provided in proposed Section 2, Article VI, four of the members of the Council will be elected every other year. The officers will of course remain Council members only during their two-year terms of office, the retiring president retaining his membership for this period, also.

Section 3: The Council shall control the funds of the Society, shall choose the Editor-in-Chief, shall have the power to fill any vacancies occurring in its

number or in any office not otherwise provided for, and shall discharge such other executive duties, not specifically provided for otherwise in this Constitution, as are necessary for the attainment of the objects of the Society and for the proper conduct of its business. It shall elect persons to membership in the Society in each grade except Fellow as provided in Article IV, Section 1. The Council shall receive and act upon charges preferred against any member of the Society, as provided in Article IV, Section 5. The Council shall have power, by vote of at least eight of its members, to draft and establish by-laws for conducting the affairs of the Society in matters not provided for herein, but no such by-laws shall abrogate or be inconsistent with any part of this constitution. Any action of the Council may be brought before the Society at large by written petition addressed to the president bearing the concurrence of not less than fifty voting members. Five members of the Council shall constitute a quorum.

This section differs essentially from the present Section 2, Article V, only in fixing the number of Council votes for action on by-laws at eight instead of seven, and in providing for appeal from any Council action by petition of not less than fifty voting members instead of one-fourth of the Senior Members and Fellows.

Article VIII: Nomination and Election of Officers and Council

Section 1: A nominating committee shall be appointed by the president, with the approval of the Council, prior to June 1 of the year in which elections are held. This committee shall, prior to September 1, make not less than four and not more than six nominations for president and vice-president, without distinction between the two offices; and not less than eight and not more than twelve nominations for members of the Council. These nominations shall be communicated to the secretary-treasurer and by him to each section of the Society, and shall be published in the official organ of the Society. Additional nominations may be made by petition of fifteen or more voting members, provided such petition is in the hands of the secretary-treasurer not later than October 15. All nominations made by the nominating committee or by petition, and accepted by the nominees, shall be submitted to the voting members for letter ballot not later than December 1.

The committee submitted a proposal that nominations should proceed from the sections, as well as from the nominating committee and from petitions. The Council, however, was rather strongly opposed to requiring or even encouraging nominations by the sections as such, because of the danger of fostering sectional antagonism. It felt that a better way to handle the matter is to require the nominating committee to make a minimum number of nominations, and to submit these to the sections and to publish them in the JOURNAL in ample time to allow for such additional nominations as the members may desire to make by petition. In order to make such nominations comparatively easy, the Council favored the plan of nomination by petition of fifteen or more voting members. The Council did not favor a proposal by the committee that nominations be made along geographical lines, believing that this can better be taken care of by proportional representation as provided in the next section.

Section 2: All elections shall be by the Hare system of proportional representation. Candidates for president and vice-president shall be voted on in one group, and candidates for the Council in another group. The candidates receiving the two largest quotas in the first group shall be declared elected president and vice-president respectively; and the candidates receiving the four largest quotas in the second group shall be declared elected members of the Council.

The Council favored the committee's recommendation that the Hare System of proportional representation be adopted by the Society because of its proved effectiveness in insuring the election of a thoroughly representative group of officers. It is already in use in many parts of the English speaking world, including the United States and Canada, for the election of municipal, state, and national legislative bodies and also for many societies such as our own. Since this system may be new to some of the members, a brief description of it will be given.

The essential features may be most easily comprehended if we imagine an election in which the voters are all gathered together in an assembly hall with the various candidates ranged at intervals along one side of it. Each person as his turn comes to vote takes his place by the side of the particular candidate he most desires to see elected. Before all voters have had a chance to range themselves in this way the most popular candidate has enough supporters by him to insure his election. Each subsequent voter who had intended to support this already successful candidate sees that he would throw his vote away by voting for him and consequently picks out another candidate whom he desires to see elected and takes his place among that candidate's supporters. When all the voters have finally indicated their choice in this manner it will be found that if the candidates with the greatest number of supporters were at once declared elected a good many persons who were supporting the defeated candidates will have wasted their votes. Accordingly the supporters of the hopelessly outnumbered candidates are given another chance to make their votes count, in the following way.

The candidate with the fewest supporters is declared defeated and his supporters are given a chance to transfer their votes to the continuing candidates most to their liking. When this transfer is completed the candidate who is found to be lowest is similarly declared defeated and his supporters are given a like opportunity to transfer. And so the process of regrouping continues until all the weaker candidates have been eliminated and all the vacancies have been filled by the election of the stronger candidates, each with an equal number of voters supporting him. This number, the "quota" necessary to elect, is determined by dividing the total number of valid ballots by one more than the number to be elected and adding one to the result. If there are 600 voters in the hall and five representatives are to be elected, the quota is 101, and there is no way in which more than five candidates can get as many as 101 votes each, no matter how the voters may eventually arrange themselves. If 110 have gathered about one candidate's banner, nine of them move on to help other favorites who are not yet sure of election. In this way the greatest possible number of voters have a real share in the choice.

Exactly what the voters would do in person in a case like the above illustration, the proportional representation system does with their ballots. The voter marks his ballot to indicate not only the candidate he most desires to see elected but also his second, third, and other choices, and the tellers are thus able to put each ballot through the same movements the voter himself would have made had he been physically present to say how he wished his vote to be transferred and counted for the several candidates in whom he was interested.

How the system would work in a factional contest can be best explained by another illustration. Assume that there are three factions, two of equal strength, each representing 40 per cent of the total vote, and the third representing the remaining 20 per cent. Five positions are to be filled, and at the outset each faction has three candidates in the field. To give each faction the representation due it, it is evident that each of the larger factions, controlling two-fifths of the vote, should elect two of its three candidates, while the smallest faction, with one-fifth of the votes, should elect one. Under the procedure described this is what would actually happen, for as the regrouping of the voters proceeds and the weaker candidates are in turn eliminated, the votes of each faction become concentrated upon and finally elect just the proper number of its most popular candidates. If the smallest faction does not have quite enough votes to insure the election of even one of its candidates unaided by outside votes, the two larger factions, having elected two candidates each, will have some votes to spare, thus leaving a more or less non-partisan contest for fifth place between the third candidate in each of the larger factions and the three candidates of the smallest faction. In this case the various supporters of these five contestants would regroup themselves until four had been eliminated and the man most satisfactory to a majority of those not already represented had been elected to the remaining vacancy.

The committee favors keeping the election of president and vice-president separate from that of the other members of the Council. No distinction between these two offices would be made either on the ballot itself or in the manner of voting. The candidate who first attained the required quota of votes, or, if two should attain it on the first ballot then the one who received the largest number of first-choice votes, would be declared elected president while the other successful candidate would be vice-president. Under the committee's proposed Section 1, Article VIII, the nominations of candidates for each list would be made in part by a nominating committee and in part by petitions of independent members.

Article IX: Editorial Board

The Editorial Board shall consist of a chairman, who shall be the Editor-in-Chief, chosen by ballot of the Executive Council, and eight (8) other Senior Members or Fellows appointed by the president. The chairman and other members of the Editorial Board shall serve for two years, or until their successors are appointed. The Board shall have charge of the official publication of the Society and shall decide all matters related to its publication, subject to such conditions as may be imposed by the Council.

This eliminates the executive committee of the Editorial Board, which has never functioned, fixes a two-year period of service for the members of the Board, and gives the Council a slightly larger measure of control over the Board than at present.

Article X. Meetings

Section 1: The Society shall hold an annual meeting and such other meetings as the Council may direct. The place and date of the annual meeting shall be selected and adequate notice given to the Society at least six months in advance of the date fixed for the meeting.

Section 2: A quorum shall consist of forty (40) voting members.

Section 3: Upon order of the Council or by direction of a majority of the voting members present at a business meeting of the Society, any question shall be submitted to the membership for decision by letter ballot.

The six sections in Article VI, of the present Constitution, need some such revisions as are given above to meet the changed conditions due to the growth of the Society since the present Constitution was adopted. The sections of the present Constitution dealing with "Executive" and "Open" meetings appear unnecessary. Practically all the Society's business used to be done in business meetings and only a portion was delegated to the Executive Committee. That was when the majority of the membership lived in Washington. Since the revision of the Constitution creating an Executive Council and Sections, the Council has handled practically all the business outside the duties of the officers. The Washington delegation has become merely a section of the Society. The annual meeting has lost its value as a representative executive gathering, and this could be restored only in some such ways as to have the sections represented by delegates or proxies carrying the authority of the sections to act for them. Otherwise the annual meeting is bound to be sectional in character. Section representation at the annual meeting, with power to vote, is clumsy and is likely to commit the Society without duly weighing the matters of policy which may be brought up. In the committee's estimation it will be far better (*a*) to retain the present power of the Council as the central, representative, and responsible agent of the Society, (*b*) to give its membership a quicker turnover, and (*c*) to provide a more democratic and more representative method of election to the Council, as provided in proposed Section 2, Article VIII.

The great value of the annual meeting is the opportunity it offers for discussions of Society policy and of papers on scientific and technical subjects, for the passage of resolutions, and generally centralizing the interests and activities of the Society. It is believed that the Society is now large enough to support a quorum of forty voting members, instead of the seven provided for in the present Constitution.

Article XI: Sections

Section 1: Sections of the Society may be authorized by the Council upon the written petition of ten (10) or more voting members, at least five (5) of whom shall be Senior Members or Fellows, resident within a territory small enough to justify the belief that a strong local organization may be effected. Sections must hold at least one meeting each year to retain their authorizations.

Section 2: The officers of each section shall include a chairman, a secretary, and such others as may be found necessary.

Section 3: Any section may, subject to the approval of the Council, adopt for its own government such by-laws as it may find expedient, including the qualifications for associate members of the Section, provided that no part thereof shall conflict with the Constitution of the Society.

Section 4: The Council shall have the right at any time to rescind the authorization of any section and to terminate its existence.

The principal changes from the present Constitution are: the requirement that instead of five Senior Members and Fellows the petitioners for a section shall consist of ten or more voting members of whom five shall be Senior Members or Fellows; and the omission of Sections 4 and 5 of the present Constitution, which can best be taken care of in the by-laws. After careful consideration, the Council decided not to approve a recommendation by the committee for student sec-

tions or for student members of the Society. The experience of some of the engineering societies entered into this decision. The subject is well worth further discussion and the committee is anxious to learn the views of as many members as possible before submitting the matter for ballot.

The committee voted to omit entirely the articles on "affiliated organizations" and on "publications." Only one organization has ever taken advantage of the present provision for affiliation, and the Council felt that so few organizations are likely to do so that it is not worth while to continue the arrangement. The one club now enrolled should, of course, be allowed to continue as an affiliated organization as long as it so desires, but if the article is omitted there will be no additions to the list.

The committee felt that publications are sufficiently taken care of in the article dealing with the Editorial Board.

Article XII. Amendment

The constitution may be amended by a two-thirds vote of the members voting, provided the proposed amendments have been submitted to all voting members at least four weeks in advance of the date set by the Council for counting the ballots. Amendments shall, unless they themselves provide otherwise, be effective immediately upon their adoption. Announcement of any amendments to the constitution shall be made by the secretary-treasurer to all members.

The important modification here is the change from "three-fourths" to "two-thirds." The committee believes that the latter is sufficient to stabilize the Constitution without making its amendment unduly difficult. It was suggested at the annual meeting, particularly in connection with the discussion of dues, that amendment should be by majority vote of those voting. This did not, however, appear to meet with the general approval.

In conclusion, the committee desires to emphasize its conviction that amendment of the present Constitution is vitally necessary if the Society is to increase in usefulness to the individual members, the profession, and the wood-using public. This is particularly the case as to the proposed increase in dues, without which the Society cannot hope to handle adequately the rapidly increasing volume of business and to grow into the position of prestige which will afford the fullest return to the individual member. The committee earnestly hopes that the individual members and the sections of the Society will carefully consider these recommendations at the earliest possible date and will return their comments promptly to the chairman of the committee. It is hoped that constructive suggestions will be received and that they will come in early enough to make feasible a final ballot by the Society before the next annual meeting.

COMMITTEE ON REVISION OF THE CONSTITUTION

E. H. FROTHINGHAM, *Chairman*
Room 610, Medical Building, Asheville, N.C.
EMANUEL FRITZ
L. S. MURPHY
C. R. TILLOTSON

SUMMER MEETING OF THE ALLEGHENY SECTION—1927

The sixth annual meeting of the Allegheny Section, Society of American Foresters, was held on July 28, 29, and 30, and consisted of a tour through the

anthracite region of Pennsylvania. A total of forty-one members and thirty-four guests attended, making the largest summer gathering held thus far.

The party left Pottsville on the morning of the twenty-eighth, with A. C. Silvius, forester of the Philadelphia and Reading Coal and Iron Company, in charge. The visitors were shown the clear cutting of fire damaged timber; the operation of a modern sawmill for the recovery of discarded mine timber; the operation of a modern colliery timber wharf; the view from one of the State's fire towers; an up-to-date power plant for furnishing electric power to collieries; and plantations on Tumbling Run, which is being developed for water supply purposes.

A stop was made for luncheon in Pottsville and during the afternoon A. C. Neumiller, forester for the Lehigh Coal and Navigation Company, showed the tourists something of the forestry work of his company. The feature of the afternoon was a visit made to the new million and a quarter dollar breaker at Coaldale, where anthracite is prepared for market. A visit was also made to a High School plantation, and many examples of the Lehigh Coal and Navigation Company's "Bill Board Forestry" were observed.

The trip was continued Friday from Hazleton, and during the morning run to Scranton many forestry operations and points of interest were pointed out. At noon the tourists were guests of the Scranton Gas and Water Company at an excellent lunch served on Lake Scranton, and in the afternoon were taken over the reservations of the Water Works by W. W. Scranton, president, and G. R. Taylor, forester of the Company. A banquet at the Hotel Holland was the feature of the evening, at which the following described forestry in the anthracite region: W. W. Scranton, G. Miles Robbins, J. M. Cloan, A. C. Silvius, and R. L. Emerick.

Saturday morning the tourists were accorded an unusual opportunity in being privileged to visit the underground workings of an anthracite mine. The party walked for several miles underground, studying the methods of mining coal and the utilization of mine timber.

The success of the tour was due largely to the untiring efforts of the committee in charge of arrangements, composed of J. M. Sloan, chairman, A. C. Silvius, R. A. Smith, R. L. Emerick, A. C. Neumiller and E. F. Brouse.

SHIRLEY W. ALLEN

TO HAVE OR NOT TO HAVE AN EXECUTIVE SECRETARY

305 Hilgard Hall
May 16, 1927.

The President
Society of American Foresters

DEAR PRESIDENT STUART:

At the last meeting of the California Section of the Society of American Foresters a petition was circulated which urged the employment of a high class forester capable of commanding a salary of $6,000 a year as an executive secretary for the Society on a half-time basis. My failure to sign this petition expresses in a negative way my attitude on the question. I would like, however, to express myself a little more positively.

My objections to the proposition are, first of all, that it proposes to fill the place with a type of man who is really unfitted to occupy the position. Every year since 1923 the need for an executive secretary to handle routine work, especially that of the secretary and treasurer, has been emphasized. All of the arguments for an executive secretary have made much of taking this routine work off the shoulders of unpaid men who are busy with other lines of work. It is obvious, however, that a $6,000 man would not "collect dues, keep financial records, handle the JOURNAL's mailing list, or conduct all correspondence for the Executive Council," as was outlined some years ago in this connection. He, or the Society, would still require a clerical secretary on a year-long basis and at a fair salary. An executive secretary of the type proposed in this petition would create more clerical work than he could possibly relieve.

Secondly, I am personally opposed to the employment by the Society of a man to include the other half of the job—the mouthpiece or lobbyist position, or whatever you wish to call it—either at $3,000 or any other salary.

At the risk of boring you with a lengthy criticism I should like to present my position a little more clearly on this matter since, perhaps, it is the position of a good many others who have opposed increased dues for the employment of an executive secretary. An understanding of the opposition's opinion should enable you and the Executive Council to win it over.

The financial side of it is not a primary consideration with me, although from a recent ballot taken in this section it appears that the increased expense is probably a consideration with a large number of those in the Society who are simply members and who live more or less isolated in the field. My objection is chiefly that I do not feel we would get adequate returns for the outlay.

In running over the arguments for an executive secretary made during the last five years and appearing in the pages of the JOURNAL OF FORESTRY, it would seem that an executive secretary is needed to handle routine duties, particularly those of the secretary and treasurer; and secondly, to become an extension forester or a mouthpiece of the Society; and thirdly, to knit the sections of the Society more closely together than they are at present. I grant the need of adequate clerical or secretarial assistance in handling all the routine work of the officers and Editorial Board. It is certainly entirely unjust to ask what we do from volunteer officers in these positions. It is obvious, however, that to perform such duties we need, first of all, a high class clerk. To perform the other duties that have been enumerated for an executive secretary we need anything but a high class clerk. Such a position would require a high class man with a good knowledge of forestry, a pleasing personality and appearance. To expect a man of that type to pound a typewriter between Legislative hearings, or to issue receipts and check over subscription lists is entirely unthinkable. The same objections would apply to him as to the $6,000 a year man advocated in the petition.

I am not at all convinced that we need a man of this type. I fully grant that difficulties are brought about by having executive officers of the Society entangled with other alliances when it comes to representing the Society; yet at the same time I cannot believe that we are suffering any essential loss on this ground. I know that officers of the Society and of the American Forestry

Association have had their opinions challenged, owing to present and past affiliations with governmental and other forestry agencies; but, on the other hand, I don't know that they have ever done anything to prove that their opinions were not personal rather than official and representative of the Society. The only questionnaire that I recollect was one regarding the Clark-McNary law which was circulated after its passage. As a matter of fact, has the Society ever been adequately polled for its opinion on any question that might come up before a Legislative hearing? Under the circumstances would not an unattached executive officer be rather a camouflage than really adding to the weight of the opinion of the Society? As Mr. Silcox pointed out quite a number of years ago, a man with imagination in the job of executive secretary would have no difficulty in finding useful jobs to do. To this I quite agree. In effect, however, I am afraid that the Society, the Executive Council, and perhaps even the President himself would be hiring a brain to do their thinking for them in all matters pertaining to the Society—substituting a monarchy for a democracy. In a word, I cannot see where the employment of a high class man such as would be required to handle the extension side of the executive secretary's job would be worth while to the Society, except by letting us be lazier in our Society relationships; and furthermore, I cannot see how the employment of a man of this type will materially solve the problem of routine work.

Personally I should like to see a sharp division between the mechanical routine work and the constructive work that requires brain power. Hire a secretary of clerical grade and training to handle the routine; let him circulate questionnaires to find out the opinion of the Society; let him send out letters to keep the sections in touch with each other and to suggest lines of activity, but by all means let the ideas behind these questionnaires and letters come from the President, Executive Council and the Society at large. It should be far more stimulating to the Society to make progress dependent upon the intelligence and activity of the individual members than in having each individual scoop out some $5.00 or $10.00 more to hire his thinking done for him.

Besides this clerical assistance to aid in the mechanics of the job I certainly feel that more money should be expended on the JOURNAL. I think one reason why we are not getting more articles of outstanding value is because they cannot be presented in a forcible way. It seems unfortunate, to say the least, that a technical journal must limit itself in tabular matter, graphic representation and illustration—three of the most forcible ways of presenting scientific facts. Possibly I am wrong in this, since recently the numerous articles on mensuration have been criticized more than once. Once upon a time I know that it was the Editor's aim to make the JOURNAL OF FORESTRY the organ of the Forest Experiment Stations. The *Journal of Agricultural Research,* perhaps, rather effectively prevented that, but at the present time it certainly has little material of value to the forest technician. Have you noted the number of speeches that have been printed recently? You know, as well as I do, that it is very seldom in a speech that new scientific facts are given publicity. It is usually a summing up of the situation by an expert. A certain amount of this is undoubtedly of value, but the set of speeches on fire that recently appeared in the JOURNAL could have had their essential parts compressed into a few paragraphs. Personally I should like

to see published some articles on silvics, silviculture, and forest geography; in fact, there are one or two I should like to write but the JOURNAL OF FORESTRY certainly does not tempt me to proceed, because the articles would not be put up in the form that I would consider adequate. I have no doubt but that a good many others feel the same way.

In conclusion, then, I say, let the silver-plated mouthpiece of the Society go. There is enough propaganda, and I mean that in a perfectly good sense, in forestry as it is, and far too little searching for fundamental facts of forestry; far too little knowledge of best methods; far too little known of what the other man is doing. Therefore, get a clerk—and a good one—and by all means spend some more money on the JOURNAL OF FORESTRY. Then, having the mechanical side of the job well built up, encourage the members, the officers, and the Executive Council to use their brains to make the JOURNAL and the secretary work to the limit for the benefit of the Society and profession.

Maybe this plan of mine would cost just as much as the executive secretary you have been talking about, nevertheless, I feel that it would be a far better expenditure of the money. Somebody said, a number of years ago, that if the Executive Council would only present a stimulating plan for the activity of the executive secretary—something that would seize upon the imagination of the Society and show them that the job was really worth while—there would be no difficulty in increasing the dues to the proper extent. There has been difficulty—I think the reason is clear—no very stimulating picture of what the secretary might do has been presented. I, quite naturally, like this plan of mine.

FREDERICK S. BAKER

Mr. F. S. Baker, May 28, 1927.
University of California,
Berkeley, California

DEAR MR. BAKER:

I am very glad to receive your letter of May 16. I wish I could receive 1,300 such letters from the membership of the Society or even 51 per cent of the number as evidence that the members are regarding Society affairs seriously and desire some positive constructive action taken to increase the Society's effectiveness. It is clear that you would like to see something done. That fact is of greater moment to me than that there may be a difference as to the way in which it should be done. I wonder after all if you and the Executive Council are very far apart.

You admit that the Society, so far at least as its routine work is concerned, should be managed effectively, and that such clerical arrangements should be made as are necessary to accomplish it. You question the need, in addition to clerical personnel, for an employee or representative of the Society with training and experience who would devote his entire time to carrying out the plans and purposes of the officers, the Executive Council, and the membership of the Society. You object specifically to a $6,000 a year Executive Secretary.

First, let us get clear on the $6,000 a year Executive Secretary idea. You apparently had in mind a petition circulated by some members of the Society that a man be employed as Executive Secretary at $6,000 a year for half-time service. You conclude, apparently still accepting the information from another

source than the Council, that the Executive Secretary will be engaged largely in legislative matters and "propaganda." You conclude further that one of the outcomes of such a move would be to have the Executive Secretary do the thinking for the officers and Executive Council and membership. The latter conclusion, apparently your own, is certainly not justified from the operation of the more prominent and effective professional societies in this country, whose officers and councils, or other directing governing bodies, control the policies, programs and plans of their societies.

You apparently admit that much good to the Society and membership will come if the routine office work and correspondence is effectively handled and more aggressive action taken by the Society within its field of interest. By recent change the Society has strengthened its clerical assistance and improved its office methods. It is still dependent, however, upon its officers and Executive Council for the handling of such routine work as involves technical skill and knowledge of business other than of a routine nature. It is to fill this need that the Executive Council has felt for some time a forester of experience, training, and standing in the profession should be employed. If a man of the proper qualifications can be had for $3,000 or $4,000 a year that is the salary the Council would pay him, but if a larger salary would be necessary to obtain the type of man needed in this position as a Society representative, the Council feels that the higher salary should be paid. This prospective position has grown in the imagination of many members into the objectional type known to them as a "lobbyist." The impression also prevails apparently that there is really no need for high-grade assistance at the present time, but that the assistance desired is a move tc expand the functioning of the Society otherwise working quite satisfactorily. As a matter of fact, such a man would be very busy handling what is now "farmed out" to the officers and members of the Executive Council and in undertaking or following up Society policy commitments already approved and made to which little or no attention has been given. One of his greatest assets would be his being on the job for the Society to serve its interests at all times.

Our estimated receipts for 1927 are $9,300; our estimated expenditures $9,900. The estimated expenditures are made up of the following items:

JOURNAL OF FORESTRY	$6,300.00
Secretarial and clerical assistance	1,500.00
Miscellaneous printing	500.00
Postage, stationery, etc.	400.00
Traveling	600.00
Contributions to other organizations	100.00
Miscellaneous	500.00
Total	$9,900.00

It will be necessary for us to make up the deficit, if it materializes, from contributions received during the year or from the Society reserve.

You will see from the above that the greater portion of our funds are put in the JOURNAL OF FORESTRY and that there is no leeway to meet the need for an Executive Secretary. Obviously, this need must be met in a special way, such as a membership campaign, by increased dues, or special contributions. The Council has felt and still feels that $5.00 a year as dues is inadequate on present

or prospective membership. The Council has recommended increased dues on two occasions but the membership has failed to approve the recommendation. The need is still present and increases as our membership increases so that there remains the question of what the Society is going to do about it. Meanwhile, you may be sure the officers and Executive Council are doing all they possibly can, and will continue to do so, to make what the Society does effective.

I return to my initial thought. If a condition can be brought about by which at least 51 per cent of the members of the Society would manifest the interest in the present situation that you have, I feel positive that the officers and Executive Council could not hold them back in their insistence that membership in the Society places on each member the financial responsibility not only to follow reasonably effective office methods in the conduct of its business but to put it in a recognized position in public affairs as representing the thought and action of professional foresters in this country. In my judgment, this objective cannot be hoped for on a $5.00 a year contribution. I know of no nationally recognized professional society within our class in that respect. On the other hand, the value of the professional society to its members and to the profession it represents is becoming so increasingly evident that membership dues are considered one of the best investments members of the profession can make. You may be interested in the attached copy of a memorandum to me from O. M. Butler, who recently held a conference on Society organization with the Executive Secretaries of several of the leading professional societies.

I hope to have the opportunity of meeting with the California Section sometime this year when I trust you will open this question wide.

R. Y. Stuart, *President*

A Spelling Bee in New England

July 18, 1927.

R. Y. Stuart, President, Society of American Foresters,

Dear Stuart:

As a means of reviving the very torpid interest of the members in the Society of American Foresters, it is suggested that a system which worked well among a few left-over knockers at a recent section meeting might be tried in other sections. It was suggested that instead of just sitting around and grousing and saying that the Society was no good, that each member present should make one specific suggestion for the improvement of the Society. This was then done in the form of a "spelling bee," each man being called on in turn to set forth his grievance or suggestion. While the suggestions may or may not be worth adopting by the Society, it is felt that if each member is asked and obliged to make one suggestion, his interest in the Society is thereby greatly strengthened. The following suggestions were made at this meeting of knockers, and are passed along as samples to be improved upon by other members:

1. *Change in the "Journal of Forestry."* It is suggested that during the present year an experiment be tried in changing the form of the Journal by issuing three consecutive numbers, each of which shall consist only of:

One inspirational article from an outstanding man, outside of the profession.
One inspirational article from a professional forester.

One prize article on technical, practical forestry or forest research; the prize being publication of such article out of all articles submitted for the month, all other articles submitted to be listed in the JOURNAL by title and author, with a two or three line digest of contents and with a statement that a mimeographed copy can be secured by sending four cents in stamps to the Secretary of the Society.

That there be given in addition to an author's name, his title and a description of the position he holds.

That a résumé of the status and progress of forestry for the month be published in each experimental issue.

That a short editorial be published.

That a list of forestry positions open, with requirements, salary, etc., be published in each issue.

That comments be asked on the change in form of the JOURNAL.

That instructions be issued to the Editor of the JOURNAL to use the blue pencil liberally.

That the money saved in publication of the JOURNAL be used by the Council in prosecuting the Society program.

2. *Closer Contact with Commercial Forestry.* It is the consensus of opinion in this group whose names appear below that the Society has been and is dominated by men in educational and governmental work, many of whom are out of touch with practical business affairs.

A very large part of the "dead" membership of the Society is probably made up of men in private work, many of whom are in business positions or closely allied to business. The question is: Are these men justified in attending Section meetings and then going back to their employers and asking them to pay for their time and expenses in attending meetings which fail to bring out discussion on forestry matters which are vital to them and to the section? Practically the only thing discussed at section meetings is general matters that are of no constructive help to a business forester in advancing the forestry business he handles. Discussion should be of such a nature as to help put forestry across with the people the forester works for, and the program of the section meetings should be so arranged that men interested in specific problems will come to discuss these questions. It is felt that many matters can be most interestingly presented, as in the case system of business instruction, by presenting all of the features of a specific problem in a forest operation which has come up for decision rather than presenting generalized principles for guidance in making forest decisions. This can be done by giving more thought to developing the programs, and, particularly, by circularizing the membership to the end that men interested in the program will come prepared to develop profitable discussion.

(Signed)

G. C. HAWKINS
Winchester, N.H.

D. E. LAUDERBURN
Brunswick, Maine

E. S. BRYANT
Harvard Club
Boston, Mass.

P. T. COOLIDGE
Bangor, Maine

C. H. FOSTER
Winchendon, Mass.

D. C. A. GALARNEAU
Hampden County League
West Springfield, Mass.

August 8, 1927.

Mr. E. S. Bryant
Harvard Club
Boston, Mass.

DEAR BRYANT:

S. B. Detwiler has transmitted the letter of July 18 signed by you, P. T. Coolidge, C. H. Foster, Dr. C. A. Galarneau, G. C. Hawkins and D. E. Lauderburn. I am very glad to receive it because it carries a frank expression of opinion. While some of the points in it are open to question and discussion the purpose of the letter is constructive. I am sending it to Raphael Zon with the suggestion that it be published in the JOURNAL.

Frankly I was more impressed with the individual letters than with the joint effort. It seemed to me for example that Foster either meant or did not mean the following when he wrote it:

> "I believe that we have started something which, boiled down, means that those concerned with the 'business of forestry' are getting damn good and sick of the old gang of teachers and civil service employees who have been running things (or rather keeping them from being run) for years."

If Foster meant this he will follow it with action and work hard for the results he desires. If he does not mean it he falls within the class of membership styled in his own letter as "dead wood in the S.A.F."

Lauderburn has apparently reacted. Let me quote from his letter:

> "If the government foresters and professors are so constant in their interest, let them, in the interest of the Society, step into the background for a few years and shove some of the commercial foresters forward, especially those who do not attend meetings. Nothing will stimulate a man's interest more than responsiblity. Let us ask Friedman to prepare a paper for the next meeting on some of the problems of forest management in the northeast. Ask Gould to come to a meeting and explain how he can get people to pay such exorbitant prices for planting stock. Get Amadon to tell us something about utilization of wood in the telephone and telegraph business. Concentrate on the non-attending foresters for a few years. Put them in the position where they will have to go to their employers and say that the Society of American Foresters has asked them for a paper on their particular subject. This will tend to put the Society on the map where the employers of foresters can see it.
>
> "The first thing we know, we may have a commercial forester as our President within a year or two and a few more on the Council and Editorial Board. We will get these men to give something to the Society and put them where they will begin to get something out of it. If then the governmental and educational men should begin to lose interest switch back to them and shove them forward."

What is to prevent Lauderburn's suggestions being put into effect short of inertia or unwillingness of E. S. Bryant, *et al,* to put them into effect? Surely the "Knockers Club," all members of the New England Section, do not expect

the national officers to run the section's program for it! Surely there are enough members of the New England Section that agree with the "Knockers Club" that they can get any kind of a program they go after! What is preventing the "Knockers Club" from getting just what it wants in the line of a program of action for the Society in New England? This group has less strength than I think it has if with the zeal it has shown in this instance it cannot have its ideas felt in New England. If those ideas are strong they can be made to prevail. If they are not strong they should and will be pushed aside. Why not change the name of your Club from the "Knockers Club" to the "Go after it Club" and play the forest game on your own ground?

Sincerely yours,

R. Y. STUART, *President*

CARLOS G. BATES HONORED

Resolutions passed at a meeting of the Central Rocky Mountain Section of the Society of American Foresters, Denver, Colorado, July 15, 1927.

WHEREAS, Our honored fellow member and associate, Carlos G. Bates, Director of the Central Rocky Mountain Forest Experiment Station, is about to leave this section of the Society as he goes to take up new work in his enlarged field of duty at the Forest Products Laboratory at Madison; and

WHEREAS, In the departure of Mr. Bates, we, in this district, are losing the founder of the Central Rocky Mountain Forest Experiment Station, the father of research work in this district, and one who has worked in this region for the advancement of forest research since the establishment of the Rocky Mountain District of Forest Service; and

WHEREAS, Mr. Bates has not merely distinguished himself and the Station by the searching and fundamental work done by him and his associates there, including the exhaustive study of forest types and of seed production, the crystallizing and correlating of successful planting practices in the Nebraska Sand Hills and an uncompleted investigation of heredity among tree species, but by his energetic and enthusiastic leadership has succeeded in making forestry research a vital part of the every day work of every forest officer in the region, as shown by the widespread studies on the various National Forests of the effect of grazing on forest reproduction, reproduction and growth after cutting, methods of thinning in all major forest types and others guided by a complete and intensive research handbook made available for foresters here; now, therefore, be it

Resolved, That as members of this section, we express through these resolutions our regret at the leaving of Mr. Bates and our sincere good wishes which follow him in his work at the Laboratory; and be it further

Resolved, That these resolutions be made a part of the minutes of this meeting and that a copy be sent to Mr. Bates, and that an additional copy be mailed to the Editor of the JOURNAL OF FORESTRY.

NEW YORK SECTION URGES EXPRESSION ON PETITION FOR PART TIME SECRETARY

The New York Section has employed a convenient means of securing a full expression of opinion on a petition for the employment at once of a part

time paid secretary for the Society. The petition, received from friends of the plan in the Society, was sent out under date of April 20 with the request that each member of the Section write to the chairman giving his opinion. The chairman's view opposing the plan was contained in the letter transmitting the petition.

It should be added, in justice to the suggestion, that its sponsors believe a part time secretary of the right type will soon bring the society to a point where employment of a full time executive would be possible. Sponsors of the petition also believe that a capable man of the necessary caliber can be found for part time service at a figure coming within the funds now available.

Society Represented on National Research Council

F. W. Besley has been appointed by President Stuart to represent the Society on the division of States Relations of the National Research Council. This division is made up of men interested in the relation of state agencies to scientific research. It has made some notable studies and publishes periodic reports. Mr. Besley will serve from July 1, 1927, to June 30, 1928.

Staebner Heads Nominating Committee

R. C. Staebner, of the Washington Section, Emanuel Fritz of the California Section, and E. O. Seicke of the Gulf Section, have been appointed as nominating committee of the Society for 1927. Mr. Staebner will serve as chairman. A president, vice-president, secretary, treasurer and one member of the Executive Council are to be nominated.

Annual Meeting of the Society

The annual meeting of the Society will be held this year at San Francisco, California, at a date not yet definitely decided upon, except that it will be between November 20 and December 15.

California Section Discusses Research

The research worker, sometimes maligned a lazy, cranky and self-centered, was defended by Arthur T. Sampson at the April meeting of the California Section. It appears, from the secretary's report, that Mr. Sampson brought out the fundamental need of investigative work to establish forestry on a scientific basis. Only in this way, he believes, will technical forestry be of permanent value. Sampson compared the opportunity of research at a university with that of federal institutions, giving the advantage to the university field on account of the obtainable co-operation of experts in subjects related to forestry.

E. I. Kotok sprung the idea of an experimental forest for the California region. He believes that a monumental experiment should be undertaken through the dedication of an entire working circle, an area large enough to allow full size logging and silvicultural and utilization activities. Kotok pointed out that there would be an ideal opportunity thus afforded to study costs, methods, efficiency of appliances, and other matters which have never been attempted. The ideal plan, according to Kotok, would be to organize a non-profit company whose capital for operating costs would be furnished by lumbermen. In closing,

Kotok all but pricked the bubble by saying "All that is required to make this experiment forest a reality is a lot of nerve and $2,000,000." So far no one has come forward with the money.

Oregon Faces Optional and Universal Tax Proposals

Sharp discussion characterized one of the fall meetings of the North Pacific Section when R. H. Chapler and George W. Peavey outlined the proposed forms for corrective tax legislation in Oregon.

Chapler explained the bill proposed by the State Legislative Reforestation Commission, of which he is executive secretary. The outstanding characteristic of this bill is the universal application of the law to all "reforestation lands." These lands would automatically fall within the law, although the owner of any timberland tract *may* enter into a contract with the state if he wishes additional protection and assurance that the law will be applied. Under this bill land classified by the State Board of Forestry as "reforestation lands" rather than "merchantable timber" is automatically subject to an annual tax of five cents per acre, and to a yield tax of twelve and a half per cent to be collected at any time forest products are harvested. Mr. Peavey, who represents the committee appointed by the State Forester, explained the bill sponsored by this committee, which would require that all lands to which the law might be applied, must be made the subject of contract by the state and the owner. Instead of a specific land tax of five cents per acre, there would be an annual assessment by lands under contract which would be subject to only fifty per cent of their regularly assessed value. The yield tax in this case would be fifteen per cent, collected at the end of a contract or rotation period, which would not exceed sixty years. Under both bills the State Board of Forestry would administer the law and appeals from the State Forester's valuation might be made to the Board of Forestry and to the Circuit Court.

Discussion centered on an effort to reconcile the two measures and to put foresters solidly behind the one to which all were agreed. No word has been received that this has been accomplished.

North Pacific Section Adopts By-Laws

On January 6, 1927, by-laws were adopted by the North Pacific Section which was established in 1915.

One unusual feature is the establishment of a committee on American Forest Week for the purpose of promoting wider observance of this occasion. Open meetings are prescribed for the Section at least five times during the year, with the apparent purpose of bringing in not only members of the Section but others who are interested in subjects to be discussed. Dues are placed at seventy-five cents a year for residents of Portland and fifty cents a year for non-residents.

Another thing provided for is the submission, at least once a year by the secretary, of an up-to-date list of the members of the Section and the names of candidates endorsed or being considered.

Society Well Represented at Georgia Fire Line Meeting

A unique demonstration, held August 31 at Waycross, Georgia, found several members of the Society in attendance to study methods of fire line

construction by tractor. The meeting was called by the Georgia State Board of Forestry in the region where so much interest has been shown in the last few years in reforestation. Preceding the plowing demonstration, the meeting was held in Waycross, addressed by R. E. Benedict, of Brunswick, on "Theory of Fire Lines," I. F. Eldridge of Suwanee Forest, on "Selection of Permanent Fire Lines" and Alexander Sessoms, of Cogdell, on "Uses of a Fire Line System."

Benedict ably presented the southern Georgia situation as a vast area covered by a tremendous blanket of inflammable material, upon which were moving thousands of people who used matches for some purpose every day. The need, he thought, was to cut this blanket up into little blankets so that the holes burned here and there would not set the entire cover on fire.

Eldridge told of the work being done by his company and spoke of primary and secondary fire lines, intimating that the former were fifty to one hundred feet wide and telling of the methods of plowing outside strips and burning between them. He emphasized the fact, to the large number of timberland owners who crowded the hall, that no fire line system was automatic, but that there must be organization for protection and suppression of fires that start.

Mr. Sessoms took occasion to reassure southern George timberland owners that the much-talked-of fire of last May on the property of his company was not an indication that fire protection was a failure, and that he did not believe with others that keeping lands in the "rough" created a prohibitive risk. He admitted that their protective system so far developed has broken down, for a short time, but that only five per cent of the area under protection had burned over. He also stated emphatically that the burned over area was in much better condition now with respect to reproduction and trees left, than other land across the fence which had been burned every year for the past five years as a protective measure.

Mr. Sessoms also described a firefighting truck used on his property and warned against overlooking the possibility of using water and portable spray pumps even though the water had to be hauled in drums to the area. He also answered the much discussed labor trouble objection to keeping turpentine leases in the "rough." He admitted that laborers on his company's land had objected to working on unburned land, but that he had no labor trouble because of insisting that the land be not burned.

Four companies had tractors lined up on a cut-over tract on the Maryland farms, near Waycross, and competitive fire line plowing started about two o'clock in the afternoon. All kinds of apparatus were represented from a road scraper to an ordinary mould board plow. Heavy disk plows made an especially good showing with few breakdowns, and remarkable speed. It was estimated that more than five hundred people, a large proportion of whom were land owners and operators, witnessed the demonstration. Among the judges were R. E. Benedict, I. F. Eldridge, Roland Turner, of the Southern Railway, Alexander Sessoms, Bonnell H. Stone, and Shirley Allen. Machinery men and operators were heard to express the thought that the necessity of fire line plowing might justify the ownership of a tractor by farmers who would not go to the expense otherwise.

B. M. Lufburrow, State Forester, announced that fourteen timber protective organizations were under way in Georgia and indicated that a fire line demonstration might be made an annual affair by the State Board.

Announcement of Candidates for Membership

The following names of candidates for membership are referred to Members, Senior Members, and Fellows, for comment or protest. The list includes all nominations received since the publication of the list of May 28, 1927, without question as to eligibility; the names have not been passed upon by the Executive Council. Important information regarding the qualifications of any candidate, which will enable the Council to take final action with a knowledge of essential facts, should be submitted in *Triplicate* to the undersigned before November 15, 1927. Statements on different men should be submitted on *different* sheets. *Communications relating to candidates are considered by the Council as strictly confidential.*

FOR ELECTION TO GRADE OF MEMBER

Name	*Title and Address*	*Proposed by*
Benedict, M. S.	Forest Supervisor, U. S. Forest Service, Hailey, Idaho	Intermountain Section
Blakeslee, W. W.	Assistant to District Engineer, U. S. Forest Service, Ogden, Utah	Intermountain Section
Bolles, Warren H.	Ranger, U. S. Forest Service, McCall, Idaho	Intermountain Section
Brackett, Charles E.	Assistant Forest Supervisor, U. S. Forest Service, Elko, Nevada.	Intermountain Section
Brown, Clair A.	Instructor of Botany, La. State University, Baton Rouge, La.	H. P. Brown, N. C. Brown, R. D. Forbes
Brundage, Roy C.	Supervisor of Reforestation, Rockland Light & Power Co., Otisville, N.Y.	N. Y. Section
Campbell, John F.	Assistant Forest Supervisor, U. S. Forest Service, Tacoma, Wash.	North Pacific Section
Clark, John C.	Landscape Architect and Forester, Syracuse, N.Y.	N. Y. Section
Comings, Wm. D.	Forester, West Virginia Pulp & Paper Co., Middletown, N.Y.	N. Y. Section
Craddock Jr., Geo. W.	Junior Range Examiner, U. S. Forest Service, Logan, Utah.	Intermountain Section

Name	*Title and Address*	*Proposed by*
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